A HOSPITAL BASED LONGITUDINAL STUDY ON OUTCOMES AND ITS ASSOCIATED FACTORS AMONG RESPIRATORY INTENSIVE CARE UNIT IN A TERTIARY CARE CENTER IN CENTRAL INDIA

THESIS SUBMITTED TO THE FACULTY OF
ALL INDIA INSTITUTE OF MEDICAL SCIENCES, BHOPAL

FOR THE AWARD OF THE DEGREE DM IN THE SUBJECT OF
PULMONARY, CRITICAL CARE AND SLEEP MEDICINE

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Following members attended the meeting:

1. Prof. D. K. Pal, Professor & HoD Community Medicine, GMC, Bhopal ..Chairperson
2. Prof. Rajnish Joshi, Professor of General Medicine, AIIMS, Bhopal..... Member
3. Prof. Amit Agrawal, Professor of Neurosurgery, AIIMS, Bhopal..... Member
4. Dr. Girish Bhat, Assoc. Professor of Paediatrics, AIIMS, Bhopal..... Member
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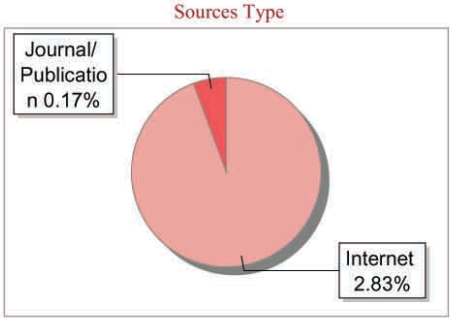

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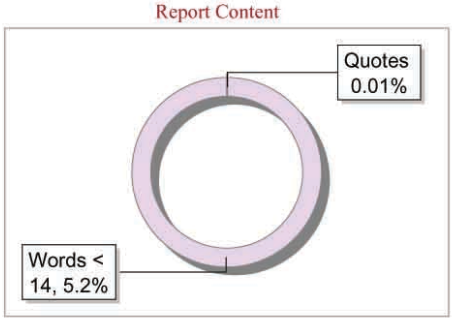

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Dr Asha Undrajavarapu

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LIST OF ABBREVIATIONS

1. ABG: Arterial Blood Gas
2. AECOPD: Acute Exacerbation of Chronic Obstructive Pulmonary Disease
3. APACHE II: Acute Physiology and Chronic Health Evaluation
4. ARDS: Acute Respiratory Distress Syndrome
5. BMI: Body Mass Index
6. BMRC: British Medical Research Council
7. COPD: Chronic Obstructive Pulmonary Disease
8. CPAP: Continuous Positive Airway Pressure
9. DT isp: Diaphragmatic Thickness in inspiration
10. DT esp: Diaphragmatic Thickness in expiration
11. ICU: Intensive Care Unit
12. ILD: Interstitial Lung Disease
13. IBW: Ideal Body Weight
14. IMV: Invasive Mechanical Ventilation Days
15. ISWD: Incremental Shuttle Walk Distance
16. NMB: Neuromuscular blockers
17. NIV: Non-Invasive Ventilation
18. PEEP: Positive End Expiratory Pressure
19. Pi max: Maximal inspiratory pressure
20. Pe max: Maximal expiratory pressure
21. RASS: Richmond Algorithm Sedation Scale
22. SBT: Spontaneous Breathing Trial
23. Simplified Acute Physiology Score
24. SF36: 36 item Short Form Health Survey questionnaire
25. RASS: Richmond Agitation Sedation Scale
26. 6MWD: 6 Minute Walk Distance
27. SpO2: Oxygen saturation

INTRODUCTION

The recent advances in the field of Critical Care Medicine have led to an increase in the percentage of patients surviving from a critical illness.

Reasons for ICU Admissions

The most common reasons for ICU admission and those necessitating mechanical ventilation in respiratory ICU includes respiratory failure due to acute respiratory distress syndrome (ARDS), exacerbation of Chronic Obstructive Pulmonary Disease (COPD), Interstitial Lung Disease (ILD) and sepsis. The LUNG-SAFE study in 2016 showed that out of 29,144 ICU admissions, 10.4% were ARDS cases. (1) Another significant reason for admission in respiratory ICUs is Community Acquired Pneumonia (CAP), with prior studies indicating 22% of CAP diagnosed patients requiring ICU admission. (2) Survival of the critically ill in the ICU is influenced by several factors: the disease necessitating ICU admission, its severity, the patient's physiological reserve, and their response to treatments. It is important to understand the factors that correlate with outcomes in critically ill patients.

Predictors of Prognosis and Outcomes

The prognosis and outcome of intensive care patients depends upon demographic factors, severity of disease and related complications, non-pulmonary organ impairment, use of non-invasive or invasive ventilation, drugs like sedatives, steroids, neuromuscular blockers, and vasopressors. To predict the prognosis and patient outcome in intensive care, severity scoring systems have been developed which can be calculated on the first day of admission to intensive care like acute physiology and

chronic health evaluation (APACHE II), simplified acute physiology score (SAPS), mortality prediction model (MPM). Factors that were independently associated with in-hospital mortality in critically ill patients are APACHE II, chronic pulmonary diseases. (3)

APACHE II Prognostic Scoring System

APACHE II was introduced in 1985, based on 12 physiological measurements, age, and chronic health. With scores ranging from 0 to 71, with higher scores known to be associated with subsequently higher risk of hospital death. The APACHE II score is amongst the most frequently used scoring system, not just to assess the severity of the disease, but to also assess the efficacy of the intensive care. (3)

Simplified Acute Physiology Score (SAPS).

In 1993, SAPS II was introduced, which considers 17 variables, including physiological data, age, admission type, and three disease variables (hematological malignancy, AIDS, and metastatic cancer). (4) Patients admitted to the ICU for respiratory illnesses manifest a wide range of outcomes, from mortality to full recovery without complications. In United States, among 5.7 million annual intensive care admissions, approximately 4.8 million survive the ICU stay. The critically ill patients are subjected to long periods of physical inactivity. The survivors are at risk of developing pulmonary function abnormalities, neuromuscular abnormalities, physical functional impairment and mental health problems. (5)

The overall mortality in mechanically ventilated patients is high and even in the survivors the quality of life is low. Cardiorespiratory co-morbidities, presence of neuromuscular diseases, use of sedation, neuromuscular blockers, corticosteroids, and

malnutrition hinder weaning from mechanical ventilator. It's essential to analyze the predictors of these outcomes to improve the survival rate and subsequent quality of life post-discharge from ICU.

Despite surviving the critical illness, many patients experience decline in functional capacity and reduced quality of life as seen in an observational study involving 718 mechanically-ventilated patients where 50% of patients experienced functional impairments. Considering this scenario, the European Society of Intensive Care advocates for early active and passive mobilization and muscle training. Such interventions have proven beneficial, enhancing physical functionality at discharge, elevating life quality, reducing duration of mechanical ventilation duration, length of hospital stay and associated costs. (6)

We therefore carried out a study on epidemiology, clinical profile, and the outcomes that predict progression in critically ill patients.

Research question: What are the outcomes and the factors responsible for them in respiratory critically ill patients in an ICU setting in Central India?

REVIEW OF LITERATURE

The outcome of an ICU admission is affected by a multitude of patient, disease, and management-related factors.

(A) Patient-Related Factors

- ***Age and gender***

There are many patient-related factors that directly affect the outcomes of patients admitted to the intensive care units. These include the age of the patient on admission, gender, nutritional status and Body Mass Index (BMI) of the patient and the presence of comorbidities. Kollef et al. carried out a prospective cohort study in 1997 on 357 patients requiring mechanical ventilation. The study was conducted with an aim to assess the impact of gender on the mortality risk in patients admitted to ICUs. The main primary outcome measure of this study was hospital mortality. The secondary outcomes of this study were length of hospital and ICU stay, duration of mechanical ventilation and need for reintubation. There were 189 women (52.9%) and 168 men (47.1%) included in the study with mean ages of 62.9±16.5 years and 61.6±17.6 years, respectively (p=0.480). The authors concluded that women requiring mechanical ventilation were at a greater risk of hospital mortality as compared to men. This difference in the risk of mortality was observed despite the similarity in the baseline demographics in both the groups, severity of illnesses and indications for mechanical ventilation. (7)

Epstein et al. in 1999 conducted a prospective observational study to assess the presence

of gender-based differences in the outcomes of mechanically ventilated patients. The study included 580 patients who were on mechanical ventilation for a minimum of 12 hours of which, 330 (57%) were males and 250 (43%) were females. The authors of this study concluded that there was no significant difference between males and females who were mechanically ventilated in the overall hospital mortality rate as well as in the duration of hospital or ICU stay ($p > 0.2$). (8)

Advanced age is a risk factor for poor outcomes in the ICU. Its association with prolonged ventilation, difficult weaning and higher mortality has been demonstrated by multiple studies. A study conducted by Tang et al. in 2003 aimed to observe the effect of age on the length of stay and overall mortality in elderly patients on mechanical ventilation in the ICU. In this prospective study, out of the total 365 mechanically ventilated patients, 206 belonged to the cohort comprising patients above the age of 65 years, and 159 belonged to the cohort with patients below the age of 65 years. The median age of the patients included in the study was 67 years, with a mean ± SD of 63.6 ± 17.4 years. The mean age of the patients in the older age cohort was s 75.7 ± 6.7 years, while the mean age of those in the younger age cohort was 48 ± 14.3 years. This study concluded that age did not play a significant role in predicting ICU and hospital mortality in elderly ventilated patients. (9)

Another study by Leong and Tai et al. showed similar results, concluding that age was not a significant factor that affected the ICU outcomes. This study was done on Asian cohorts. All the patients above the age of 55 years in the year 1998 were included in this study. The patients were categorized into 4 groups: the reference group (aged 55 to 64 years), the young old group (65 to 74 years), the old group (75 to 84 years) and the oldest old group (85 years and older). A total of 262 patients were enrolled, out of which

61% were males. The difference in the mortality rates in different age groups was found to be statistically insignificant (p = 0.08). However, in this study, not all the included patients were on mechanical ventilation. (10)

It was noted by Frezza et al. that older patients stayed for a longer duration in the ICU as compared to younger cohorts. (11) However, in another study by Ely et al. it was found that the length of stay in the ICU and hospital, after adjusting for the severity of illness, did not differ significantly in the elderly group as compared to the younger group of patients. In this study, the patients were divided into two groups (one group below the age of 75 years and the other group above the age of 75 years. There were 63 patients older than 75 years of age and 237 patients below the age of 75 years. The length of time on mechanical ventilation was not found to be significantly different in the two groups (p = 0.14). The total in-hospital mortality rate was found to be 38.1% in the age group above 75 years as compared to 38.8% in the younger age group. Again, this was not found to be statistically significant (p >0.2). (12) Zilberberg et al. and Epstein et al. in their study, found that age >65 years was an independent predictor of death. Their study was carried out over a 36-month period including a total of 107 patients. Again, the patients were categorized based on their age, with 65 years as the threshold mark. (8)

- ***BMI***

Effect of BMI on the outcomes of critically ill patients has been mixed. Trembley et al. conducted a retrospective analysis in 2003 of a large multi-institutional ICU database to determine the impact of body mass index (BMI) on critically ill patients. The study included a total of 41,011 patients. It was concluded that there is an increased risk of

mortality in underweight (BMI < 20 kg/m^2) patients. However, there was no increase in mortality found in overweight (BMI 25 to 30 kg/m^2), obese (BMI 30 to 40 kg/m^2) or severely obese (BMI >40 kg/m^2) patients. It was also demonstrated that the ICU and hospital length of stay was increased significantly in the underweight and severely obese patients. Thus, the authors concluded that low BMI, but not high BMI, is associated with increased mortality and worsened hospital discharge functional status. (13)

Ray et al. conducted a prospective study to determine the effect of BMI on ICU outcomes. The patients included were classified into groups based on their BMI. These included BMI <19kg/m^2 (n= 350), BMI ≥19 kg/$m^2$and <25kg/m^2(n = 663), ≥ 25.0 kg/$m^2$and < 29.9kg/m^2 (n = 585), ≥ 30.0 kg/$m^2$and < 40.0 kg/m^2(n = 396), and ≥ 40.0kg/m^2 (n = 154). They found that there was no significant difference between the BMI groups in relation to their ICU or overall hospital length of stay, days on mechanical ventilation or mortality rate. Thus, it was concluded that despite the physiological changes in the obese population as well as the subsequent increased risk of complications, obesity was not found to increase the mortality or morbidity in the ICU. (13)

In another study by Lee et al. conducted on patients admitted to the ICU and requiring mechanical ventilation, it was concluded that obesity did not have a significant influence on the outcomes in these patients. This was a retrospective study which included a total of 504 patients. The patients were categorized into two groups as nonobese (BMI <30kg/m^2) and obese (BMI ≥30kg/m^2). There was a total of 306 nonobese patients, while the remaining 198 (39%) were obese. There was no significant difference found in the mortality up to 30 days between the two groups. (14)

Martino et al. carried out a study to determine the effect of extreme obesity on the outcomes of critically ill patients. A total of 8,813 patients were included in this survey, out of which 423 patients were underweight (BMI <18.5kg/m^2), 3,490 were normal-weight patients (BMI 18.5 to 25 kg/m^2), 2604 were overweight patients (BMI 25 to 30 kg/m^2), 1772 were obese patients (BMI 30 to 40 kg/m^2) and 524 extremely obese patients (BMI > 40 kg/m^2). When the outcomes were compared between the patients who were extremely obese and those who were of normal weight, it was found that the 60-day mortality rate was significantly lower in the group with extreme obesity (17.2% mortality vs 28.9% mortality, $P = .04$). Their conclusions were similar to previous studies, stating that even extreme obesity is not associated with a worse outcome. (15)

- ***Co-morbidities***

The presence of comorbidities may also play a significant role in the outcomes in mechanically ventilated patients in the ICU. A vast number of admissions in the respiratory ICU are due to COPD. Cardiovascular disorders, Diabetes Mellitus (DM), hypertension, lung cancer, infections and other comorbidities may affect the outcomes in these patients. Among them, cardiovascular co-morbidities (hypertension, CAD, arrhythmia, and heart failure) are the most common in COPD.

A study by Ongel et al. to assess the same concluded that patients admitted with COPD with associated cardiac comorbidities and cachexia must be closely monitored. These patients have reported an increase in the risk of ICU mortality. This was a retrospective, observational, cohort study including patients that were previously diagnosed with COPD and then admitted to the ICU with a diagnosis of acute respiratory failure. This totaled 1013 patients were classified into survivors and non-survivors. In the non-

survivor's group, the presence of Pneumonia was significantly higher ($p < 0.001$). (16) In a study consisting of 20,296 COPD patients, the incidence of DM and hypertension was found to be 12.7% and 40.1%, respectively. In this study by Mannino et al. the overall 5-year mortality was found to be 5.9%, which showed a significant increase in the presence of DM and other cardiovascular comorbidities. It was also found that these patients had a higher rate of hospitalization in the presence of these comorbidities. (17)

(B) Disease-specific outcomes

Respiratory pathologies constitute a vast number of diseases which make them land up in an Intensive Care setting. One important distinction in respiratory setting is COPD Vs non-COPD patients.

Nseir et al. aimed to determine the impact of Ventilator-Associated Pneumonia (VAP) on the outcomes in patients with COPD. This was a prospective, observational study consisting of 1,241 patients. Patients with COPD were reported to have higher mortality compared to patients without COPD (64% vs. 26%) and also had a longer duration of mechanical ventilation (24 versus 13 days) and ICU stay (26 versus 15 days). VAP was the only independent factor which was significantly associated with ICU mortality ($p < 0.001$). It was also associated with a longer stay in the ICU and a longer duration of mechanical ventilation. (18) Ucgun et al. conducted a prospective study using the data they obtained from patients admitted with acute exacerbation of COPD and hypercapnic respiratory failure in the first 24 hours of respiratory ICU admission. They monitored 656 consecutive patients to determine and identify the factors affecting the mortality in COPD patients. The mean age of the patients was 65.1 and the mean APACHE II score was 23.7. The mean length of stay in the ICU and hospital were 6.9 and 10.9 days,

respectively. The authors further concluded that patients admitted to the ICU for acute hypercapnic respiratory failure due to COPD are at a significant risk for death in the hospital. (19)

In 2015, a study was conducted by Saltürk et al. to determine whether eosinophilic COPD exacerbations have a better outcome as compared to non-eosinophilic COPD exacerbations in patients admitted to the ICU. In total, 647 eligible COPD patients were included in this study. Patients were divided into two groups based on their peripheral eosinophilic count. Group 1 included those with an eosinophilic count of > 2% (eosinophilic COPD) and Group 2 consisted of those with an eosinophilic count of ≤2% (non-eosinophilic COPD). It was found that the presence of septic shock, age of more than 80 years, arrhythmia, resistant pathogen infection, and a CRP greater than 50 mg/ml were all found to be statistically significant risk factors for mortality. As against this, the prior use of home NIV was found to significantly reduce the risk of mortality in the patients admitted to the ICU. This study concluded that eosinophilic COPD exacerbations with acute respiratory failure necessitating admission to the ICU had a better outcome. (20)

In 2018, Gadre et al. in their study demonstrated that patients with severe COPD presenting with acute respiratory failure requiring mechanical ventilation have a significant long-term morbidity and a higher risk of mortality. This was a single-centre retrospective study which included 670 patients in total. The patients with severe COPD admitted to the ICU for mechanical ventilation required due to the presence of acute respiratory failure were included in the study. The mean age of the patients was 63.6±12.4 years and 46.9% of the total patients were males. (21)

A similar study by Afessa et al. was conducted prospectively to analyze the prognostic factors and outcomes in COPD patients admitted to the ICU with acute respiratory failure. Data of 180 patients admitted to the ICU with acute respiratory failure with COPD were analyzed. The mean age of the patients was 63.1 years and 59% of them were males. The APACHE II predicted mortality rate ($p = 0.0001$) and the number of organ failures ($p < 0.0001$) were significant independent predictors of hospital outcomes. They demonstrated that physiologic abnormalities at the time of admission of these patients to the ICU and the development of non-respiratory organ failure play an important role in determining the outcome of these patients. (22)

Acute Respiratory Distress Syndrome (ARDS) presents as a complication of a variety of different diseases. While the understanding of the disease, including the pathogenesis, risk factors and management has improved over the last few decades, the incidence of ARDS still remains high. (23) The overall mortality from this disease remains high in the ICU setting. (24) A study by Villar et al. – "The Alien Study" was a study conducted to determine the incidence and outcome of ARDS in the current era of lung-protected ventilation. The study concluded that the overall mortality in the hospital and in the ICU in patients with ARDS still remains higher than 40%. Thus, this study proves that patients with ARDS, irrespective of the underlying cause, present with worse outcomes in the ICU and a poor survival rate. (25)

In ARDS, the etiology significantly affects the mortality, with COVID-19 ARDS being associated with a longer duration of mechanical ventilation and lower rates of weaning compared to non-COVID-19 ARDS. ARDS secondary to a pulmonary cause is associated with higher mortality compared to non-pulmonary cause. Among the 203 survivors of ARDS who participated in the ARDS Network randomized trial, physical

outcomes assessment revealed substantial decline in the 6MWD, and SF 36 compared to predicted. A significant association was found with the mean daily dose of steroids and the length of ICU stay among patients with ARDS. (26)

(C) Scoring Systems

- ***APACHE II Prognostic Scoring System***

APACHE II score is a severity scoring system usually evaluated at the time of admission. It consists of three criteria -acute physiologic score (APS), age and history of chronic diseases. The total score ranges between 0-71. Higher scores indicate a higher mortality rate. (27) Sayedul Islam. in 2013, conducted a prospective observational study to determine the impact of acute physiology and chronic health evaluation (APACHE) score as a significant parameter of weaning outcome for mechanical ventilation. The study included a total of 40 patients admitted to the ICU who required mechanical ventilation. The APACHE score was divided into High (score >25), Medium (score 20 – 25) and Low (score < 20). Of the total patients, 55% were males. The mean age of the patients was 52.1±13.9 years. In this study, a total of 25 (62.5%) patients were successfully weaned off mechanical ventilation. Of these, 17 (68%) of the patients had a Low APACHE II score as compared to the patients who failed to be weaned off mechanical ventilation which was statistically significant. The study concluded that the overall severity of illness as assessed by the APACHE II score correlates better with the weaning outcome. (27)

Chen et al. aimed to study how the APACHE II scores help predict mortality in ICU patient's post-discharge. They conducted a 6-month long prospective study in patients being discharged from the medical ICU. The study found that patients in whom the

APACHE II score at the time of discharge from the ICU was 17 or greater reported a mortality rate of 37.3%. As against this, patients whose APACHE II scores at the time of discharge from the ICU were lower than 17 had a mortality rate of 9.4% ($p < 0.0001$). Patients in the group with higher APACHE II scores were significantly older ($p < 0.0001$) and a higher proportion of these patients' required tracheostomy during their ICU stay ($p < 0.0001$). (28)

The APACHE II score has been widely used in the ICU setting to assess the prognosis and outcomes of patients. However, its reliability and accuracy have been questioned by a few studies. In 2022. Tian et al. carried out a study to assess the accuracy of the APACHE II scores on different days in critically ill patients. They were interested in evaluating the best time point at which the APACHE II score predicts the mortality outcome in the patients admitted to the ICU. A total of 6,374 critically ill patients were included in the study. APACHE II scores were recorded on Days 1, 2, 3, 5, 7, 14 and 28. The study concluded that the Day 3 APACHE II score was demonstrated to be the optimum biomarker in predicting the outcome in these critically ill patients. Also, in the scoring system (0-71), 17 was concluded to be the best cut-off for defining those patients at a high risk of ICU mortality. (29)

- ***Simplified Acute Physiology Score (SAPS) II***

There are various studies that have compared the APACHE II scoring system with the SAPS II scoring system in predicting the outcomes in critically ill patients. Faruq et al. conducted a prospective observational study to compare the predictive values of the two scoring systems in critically ill patients in Bangladesh. A total of 194 patients were included in this study. Based on this study, the authors concluded that both scoring

systems have a good predictive value. However, the APACHE II scoring system performed better with regard to predicting mortality in ICU patients. (30)Another study carried out by Khwannimit et al. aimed at comparing the two scoring systems in predicting hospital mortality in Thai adult ICUs. Again, this was a prospective observational study including 1316 patients in total. The results of this study were contradictory to those in the previous study by Faruq et al. (30) This study concluded that both of these scoring systems showed poor calibration and performance while predicting the mortality in patients admitted to the ICUs in Thailand. They further concluded that better scoring systems are needed to improve the predictive value in such scenarios. (31)

Similar results were found in a study by Aminiahidashti et al. where the authors found that both of these studies lacked perfect calibration. The study showed that APACHE II and SAPS II were both similar with regard to predicting hospital mortality. (32)

(D)Drugs in the ICU

Steroids, neuromuscular blockers, and sedation are frequently used in intensive care. Use of steroids has its risks and benefits in mechanically ventilated patients. Potential benefit of steroid use in ARDS and septic shock patients is well documented.

The RECOVERY trial, a large, open-labelled randomized controlled trial demonstrated that corticosteroid use in Covid-19 ARDS patients (dexamethasone 6mg/day) caused a 29% reduction in mortality in mechanically ventilated patients. The patients were randomly allotted to two groups – the dexamethasone group and the usual care group. The dexamethasone group comprised of 2104 patients in total, while the usual care group comprised of 4321 patients. On analyzing 28 days after randomization, 22.9% of

the patients in the dexamethasone group died, as compared to 25.7% in the usual care group ($p < 0.001$). Amongst the patients receiving invasive mechanical, the incidence of death was reported to be lower in the dexamethasone group (29.3%) as compared to the usual care group (41.4%). Amongst the patients receiving oxygen without invasive mechanical ventilation the results were similar and the death in the dexamethasone group was lower (23.3%) as compared to the usual care group (26.2%). However, on the contrary, amongst the patients who received no respiratory support at the time of randomization, the incidence of mortality was lower in the usual care group (14%) as compared to the dexamethasone group (17.8%). Thus, this trial concluded that in case of patients admitted with Covid-19, when prescribed dexamethasone, the 28-day mortality is reported to be lower in those receiving oxygen alone or on invasive mechanical ventilation, but not in those with no respiratory support. (33)

The Codex trial was conducted by Tomazini et al. in 2020. The trial was carried out to determine the impact of the use of intravenous dexamethasone on the number of ventilator-free days in patients admitted with Covid-19 associated ARDS. This was a randomized, multicenter, open-label trial conducted amongst a total of 41 ICUs in Brazil. The two arms of the trial included one that received the standard of care alone ($n = 148$) and the other arm that received 20mg of intravenous dexamethasone for 5 days, 10 mg of dexamethasone for 5 days or till the time of discharge from the ICU plus the standard of care ($n = 151$). Thus, a total of 299 patients were included in the trial. The patients randomized to the dexamethasone group were reported to have a mean of 6.6 ventilator-free days in the first 28 days as compared to 4 ventilator-free days in the arm that did not receive dexamethasone ($p = 0.04$). No significant difference was found in the two groups with regard to the 28-day mortality, ICU-free days in the first 28 days

and the duration of mechanical duration in the first 28 days. Thus, it was concluded from this trial that in patients with Covid-19 associated ARDS admitted to the ICU, the use of intravenous dexamethasone significantly increases the number of ventilator-free days in the first 28 days. (34)

On the contrary, some studies demonstrate opposite results. Corticosteroids are used frequently in the ICUs. However, it is important to be cautious with their use in patients with ICU-acquired pneumonia.

Ranzani et al. conducted a prospective study in 2012 to determine the impact of the use of corticosteroids in patients presenting with ICU-acquired pneumonia. They aimed to study the outcomes affected and the overall influence of its use. The primary outcome was the comparison of the 28-day mortality after ICU-acquired pneumonia was diagnosed in patients who received corticosteroid treatment versus those who did not. A total of 316 patients were analyzed prospectively. The study concluded that systemic corticosteroids must be used with extreme caution in critically ill patients as they are strongly associated with increased risk of death in patients diagnosed with ICU-acquired pneumonia. (35)

Wieruszewski et al. conducted a retrospective cohort study in 2017, to determine the influence of the use of adjunctive corticosteroids in patients with *Pneumocystis jirovecii* pneumonia (PCP) without HIV. A total of 323 patients met the eligibility criteria and were included in the study cohort. A total of 80% of the patients received corticosteroids in the first 48 hours (early steroid group), and the remaining 20% did not receive the same (no early steroid group). There was no significant difference found in the overall mortality, length of ICU stays or need for mechanical ventilation between

the two groups. (36)

Martin-Loeches et al. conducted a prospective, multi-center study to determine the impact of use of corticosteroids in patients affected by H1N1. They analyzed the data from 220 patients admitted to the ICU diagnosed with the H1N1 influenza A virus. Amongst these, 126 (57.3%) of the patients received corticosteroids on admission to the ICU. It was reported that patients who received corticosteroids had an increased chance of developing hospital-acquired pneumonia (HAP) ($p < 0.05$). Also, the patients who received corticosteroids had a significantly higher ICU mortality as compared to the patients who did not ($p < 0.01$). Thus, the authors further concluded that the use of corticosteroids in patients admitted to the ICU with H1N1 did not have better outcomes, but were associated with an increased risk of super infections. (37)

Neuromuscular blockers are used in ICU to facilitate mechanical ventilation. Though they prevent patient-ventilator synchrony and barotrauma, their long-term use can be detrimental as they may lead to muscle weakness. Alejandro et al. conducted a prospective multicenter study to determine the use of sedatives and neuromuscular blocking agents (NMBs) and their impact on the outcome in patients on mechanical ventilation. They analyzed data from 5,183 patients who had been on mechanical ventilation for > 12 hours. They considered that the patient had received the concerned drug when it had been administered for a period of at least 3 hours in a 24-hour period. When comparing patients on sustained use of sedatives, it was found that its persistent use was significantly associated with more days on mechanical ventilation as compared to those who did not receive sedation ($p < 0.001$). The persistent use of sedation was also significantly associated with more weaning days and longer stays in the ICU as compared to those who did not receive any sedation ($p < 0.001$ for both). Similarly, the

use of NMBs was also found to be significantly associated with a longer duration of mechanical ventilation, higher mortality and longer stay in the ICU. (38)

Papazian et al. carried out a multicenter double-blind trial in patients diagnosed with ARDS on mechanical ventilation in the ICU. They aimed to evaluate the clinical outcomes after 2 days of therapy with NMBs in these patients. A total of 340 patients were included in the trial. These patients were randomly assigned to receive either cisatracurium besylate for 48 hours (n = 178) or placebo (n = 162). The primary outcome measure of this trial was the number of patients who died either before being discharged from the hospital or within 90 days of being enrolled in the study. It was found that the crude 90-day mortality was 31.6% in the cisatracurium besylate group as compared to 40.7% in the placebo group (p = 0.08). The 28-day mortality was 23.7% in the cisatracurium besylate group as compared to 33.3% in the placebo group (p = 0.05). The rate of ICU-related paresis was not significantly different in the two groups. Thus, it was concluded from this trial that in patients with severe ARDS, an early administration of NMBs improves the 90-day survival rate and is reported to increase the time off mechanical ventilation without increasing muscle weakness. (39)

A randomized trial was conducted by Carson et al. to compare the duration of mechanical ventilation in patients receiving an intermittent bolus administration of lorazepam as against continuous infusion of propofol with daily sedation interruption. This was a randomized open-label trial. The primary outcome measure of this trial was the total duration of mechanical ventilation and secondary outcomes included the length of stay in the ICU and hospital, 28-day ventilator-free survival and hospital mortality. The median ventilator days were found to be significantly lower in the propofol group as compared to the lorazepam group (p = 0.04). It was also found that there was a trend

towards greater ventilator-free survival in the propofol group as compared to the group of patients that received lorazepam ($p = 0.06$). Thus, it was overall concluded that for patients receiving mechanical ventilation for > 48 hours, sedation with propofol has better outcomes as compared to sedation with lorazepam. (40)

(E)Diaphragmatic thickness

The diaphragm being the major inspiratory muscle plays a major role in successful weaning from the ventilator. Mechanical ventilation leads to disuse atrophy and ultrastructural changes in muscle fibers leading to weaning failure.

Goligher et al. performed a study to determine if the atrophy of the diaphragm that develops due to mechanical ventilation further prolongs ventilation in these patients. Diaphragm ultrasound was performed to measure the diaphragm thickness daily in the adults requiring invasive mechanical ventilation. Out of the total patients enrolled, 191 had two or more diaphragm thickness measurements. It was reported that the thickness of the diaphragm decreased by more than 10% in 78 (41%) patients. This decreased thickness further led to a decreased daily probability of being liberated from the ventilator and prolonged ICU stay. This was further associated with a higher risk of complications. The development of increased thickness of the diaphragm in 24% of the patients also predicted prolonged ventilation. Thus, this study concluded that the atrophy resulting from prolonged mechanical ventilation strongly impacts the clinical outcomes of these patients. (41)

Ali et al, conducted a study that focused on using the thickness of the diaphragm measured by ultrasound as a predictor of weaning outcome. The study included a total of 60 patients on invasive mechanical ventilation and another group with 20 controls

who were healthy patients and not on invasive mechanical ventilation. The authors concluded that Mean Diaphragmatic Thickness (MDT) of >2mm predicts successful weaning with a sensitivity of 79.3% and specificity of 77.7 %. (42)

A study by Hadda et al. was conducted to examine the impact of the decline in diaphragmatic thickness in patients with sepsis on the overall outcomes. It was a prospective study including a total of 70 patients with sepsis whose diaphragmatic thickness was measured both during inspiration (DTinsp) and expiration (DTexp). Diaphragm thickness on days 1, 3, 5, 10 and 14 were measured. The mean DTinsp and DTexp (mm) on day-1 were recorded to be 2.84 and 2.33, respectively. The study concluded that the decline in the thickness of the diaphragm is associated with worse in-hospital outcomes as well as worse short-term post-discharge outcomes. (43)

(F) Early exercise training

Prolonged bed rest and immobility associated with mechanical ventilation leads to disuse atrophy which may decrease the possibility of successful weaning and exercise capacity after ICU discharge. Early mobilization and passive exercises can overcome this problem. Early exercise training was shown to shorten the duration of hospital stay. (44) A Strong association was found between handgrip strength and ICU-free days. (45) It was shown that daily cycle sessions with bedside ergometer improved functional exercise capacity and muscle force at hospital discharge in ICU survivors. (46) Adverse events like extubation, desaturation, hypertension, and falls are reported during early exercise training and range from less than 5%-16%. (47,48)

Outcome parameters

Outcomes of ICU admission may be death or recovery from disease with or without sequelae. Sequelae can be pulmonary due to mechanical ventilation, neurological due to drugs or hypoxic episodes or musculoskeletal due to prolonged immobility and use of steroids and neuromuscular blockers.

Mortality and Length of Hospital Stay:

Overall mortality in ICU admissions as per US data is about 20%. The various factors responsible for mortality include higher age, underlying diagnosis, presence of comorbidities, severity of illness and development of complications like hospital-acquired infections (HAP, VAP, CLABSI) and pneumothorax. Increased mortality is seen with invasive mechanical ventilation as compared to non-invasive ventilation (88% versus 62%). Etiology of ARDS has varied effects on mortality with the pulmonary cause being associated with higher mortality as per Arroliga et al. and lower mortality as per Neto et al. (38,49) Among COPD patients, higher APACHE II scores correlate with mortality, (27) whereas in other studies low APACHE II score of 13 was associated with mortality. (16) Presence of pneumonia is associated with increased mortality in ICU. (50) Tsai et al., reported that NIV use was associated with lower mortality and shorter hospital stays as compared to invasive mechanical ventilation. Length of stay increases with sedation use, neuromuscular weakness and decreased diaphragmatic thickness. (51)

Quality of Life, Functional Exercise Capacity & Muscle Strength:

The survivors of critical illness have decreased functional capacity and a poor quality of life. In an observational study of 718 patients who required mechanical

ventilation for more than 14 days, about 50% reported mild to moderate functional impairment. (46) Early exercise training was associated with better functional exercise capacity and improved quality of life. Early mobilization was associated with higher SF-36 as compared to late mobilization. Survivors of the ATLOS study demonstrated significant impairments in outcome measures (6MWD, SF-36) and found a significant association between the mean dose of corticosteroids and length of ICU stay. The mean percent-predicted values for 6MWD and SF-36 were 64% ±22% and 61% ±36%. (52) A study conducted by Schweikert et al. has not shown any statistical difference between early and late mobilization. (53) British Medical Research Council (MRC) score can be used to assess limb muscle strength with scores ranging from 0 (total paralysis) to 60 (normal. Muscle strength). Severe weakness is defined as a score <36 and ICU-acquired weakness is MRC score <48. Lower MRC scores were independently associated with a higher risk of reintubation. (54)

Patients with respiratory illnesses admitted to the ICU have diverse outcomes varying from death to recovery without sequelae. The predictors determining the outcome of the patient need to be studied to improve the survival rate of ICU patients. After survival, increased functional capacity and better quality of life should be the 2nd goal of critical care management. Hence, we conducted this study to see the outcome predictors and their effect on mortality, functional capacity, and quality of life, so that appropriate practices can be followed to improve the outcomes in terms of both death and quality of life.

Physical Functioning

A study by Bienvenu et al., was conducted to assess the 2-year incidence and duration

of depression and physical impairment in patients with Acute Lung Injury (ALI). The authors followed up on a total of 186 ALI survivors for a period of 2 years. They found that the incidences of depressive symptoms and impaired physical function were 40% and 66% respectively. The greatest incidence was found at 3 months follow up period. The study concluded that long lasting depressive symptoms and an impairment in physical functioning are common during the first 2 years following ALI. (55)

Heyland et al. conducted a prospective cohort study on 610 patients from 22 Canadian hospitals, aged 80 years or older. The patients included were admitted to the ICU for a minimum of 24 hours. The study's primary outcome was physical recovery from critical illness at 12 months. The study found the mortality to be 14% in the ICU, 26% in the hospital and 44% at the end of 12 months. Of the total 505 patients that were evaluable at the end of 12 months, 26% achieved physical recovery. The study concluded that routine assessment of baseline physical function and the fragility status could aid in the prognostication of old critically ill patients. (56)

Patients requiring prolonged mechanical ventilation in the ICU due to various reasons have worse outcomes with regard to mortality and length of stay in the hospital and ICU. Spicher et al. confirmed this in their study conducted retrospectively including 250 consecutive patients who required at least 10 days of mechanical ventilation in a period of 5 years. The study demonstrated that the age and functional status of the patients prior to requiring mechanical ventilation were the best parameters to predict survival. In addition, the study found that cases with neurological disease or postoperative reasons as the cause for respiratory failure have a higher survival rate. As against this, patients with cardiac or pulmonary disease as the cause of respiratory failure have a poor prognosis and survival. (57)

AIMS AND OBJECTIVES

Primary Objective:

a.) To describe demographical and clinical profile, clinical outcomes in terms of mortality, length of ICU and hospital stay, exercise capacity, muscle strength and quality of life of admissions in Respiratory Intensive Care Unit.

Secondary Objective:

b) To study the factors associated (such as APACHE II score, diaphragmatic thickness, Dose of sedation/paralytics/steroids/vasopressors/early exercise training) with the clinical outcomes described above.

MATERIALS AND METHODS

Study setting:

The study was done in in the patients getting admitted to Respiratory Intensive Care Unit at AIIMS Bhopal. Pulmonary rehabilitation was carried out under the monitoring of doctor and a trained rehabilitation staff.

Study population:

Adult patients (age more than 18years) fulfilling the inclusion criteria were recruited.

Study duration:

This study was done over a total duration of 18 months

Study design:

It was a hospital based longitudinal study done in AIIMS Bhopal.

Inclusion criteria:

- Adults >18y age admitted to the Respiratory ICU. Only those patients with a stay of more than 72 hours in ICU will be finally included.
- Family consent

Exclusion criteria:

- ICU stay < 3 days in total
- Family not giving consent

Statistical Analysis and Sample Size:

Primary objective of this study is descriptive in nature and doesn't involve any formal hypothesis for testing. We enrolled all eligible patients admitted in RICU during data collection period of this study. Bases on previous hospital admission records we recruited 82 patients during data collection period. The descriptive statistics were

calculated and for the analysis of secondary objective, the estimates of power for statistical test were applied.

Statistical Analysis:

Statistical Methods and Their Application:

The distribution of data for the nominal variables was summarized as frequency with percentage. The data for the continuous variables were expressed as mean with S.D, whereas non-nominal distributions were expressed as median with interquartile range. ANOVA (Analysis of Variance) test was employed to compare means across multiple groups, especially when assessing variations in parameters such as hand grip strength across different age groups or demographics. Chi-square tests have been used to examine relationships between categorical variables, such as the prevalence of respiratory comorbidities across different age groups.

Scatter plots were used to visually depict relationships between parameters, such as the relationship between SBT-quadriceps strength and ICU outcomes. Heatmaps were utilized to capture Pearson correlation coefficients between various test scores and ICU-related outcomes. Multivariate Analysis was used to examine ICU outcomes among participants, identifying potential predictive factors. Pearson's correlation was extensively used to understand linear relationships between parameters. .

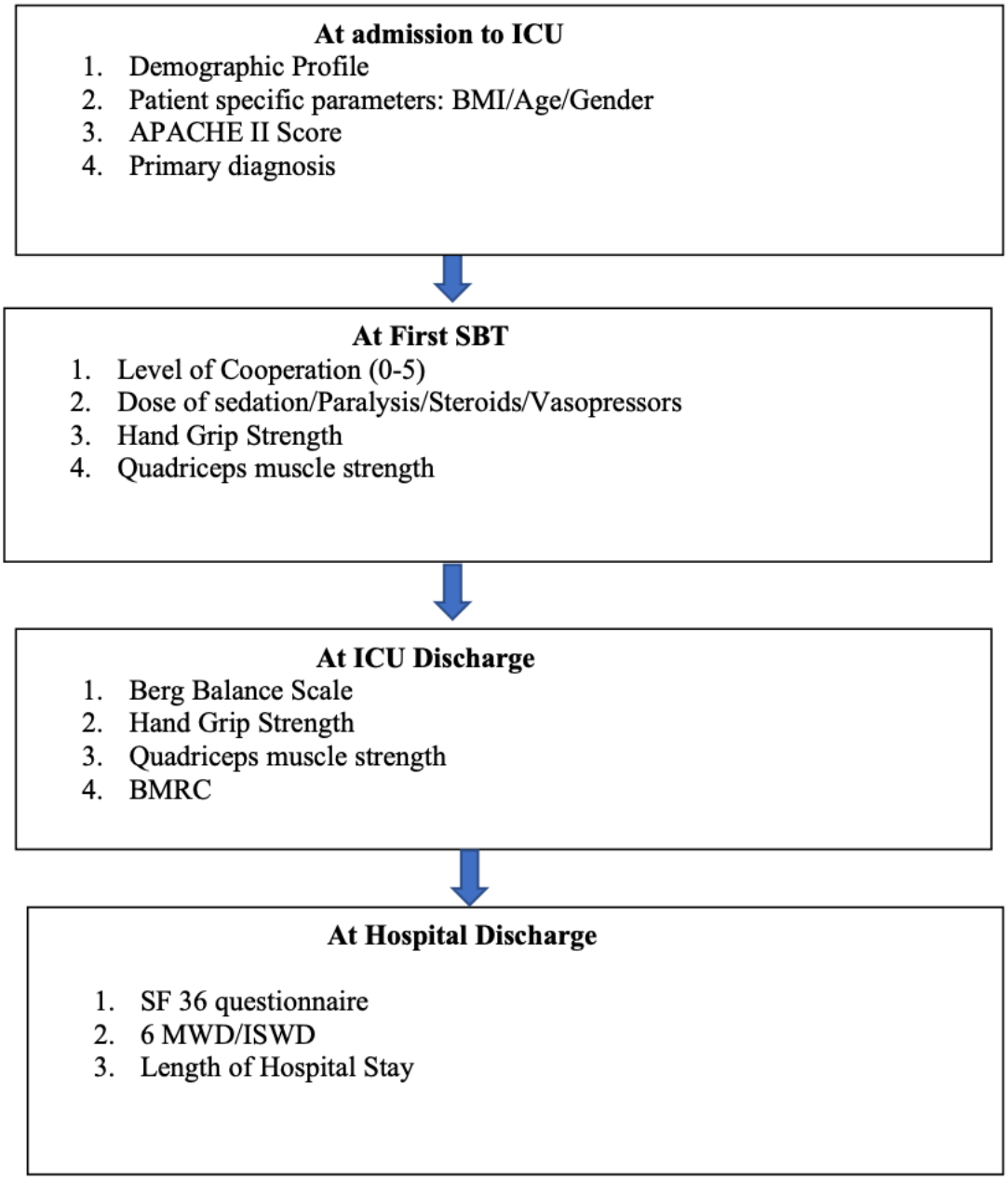
Study Protocol:

Adults >18y age admitted to the Respiratory ICU and only those patients with a stay of more than 72 hours in ICU were finally included. During the hospitalization, physical and functional status will be recorded at 4 time points: Baseline assessment on ICU

admission, during the first Spontaneous Breathing Trial, at ICU discharge and at hospital discharge.

- At the time of admission to ICU: Baseline assessment was done and the severity of illness score the APACHE II (Acute Physiology and Chronic Health Evaluation II) were computed. Sedation and delirium status was measured by RASS (Richmond Agitation Sedation Scale). Ultrasound assessment of diaphragmatic thickness was done on admission to ICU.
- Following the first spontaneous breathing trial (SBT): After assessing appropriateness, feasibility for active rehabilitation therapy, the muscle strength of the upper and lower limbs and respiratory muscle strength were assessed. In deeply sedated patients, passive physiotherapy was done and cooperative and conscious patients, volitional evaluation of muscle strength was done. Inspiratory Muscle Training (IMT) and upper and lower limb physiotherapy was provided to patients by portable bicycle exercise pedals provided they are stable in terms of cardiorespiratory reserves.
- During the ICU course of stay: The cumulative dose of steroids, vasopressors, sedation and neuromuscular agents were recorded.
- At the time of ICU discharge: The following parameters were reassessed – Muscle strength (as assessed by Quadriceps strength and Hand-Held Dynamometer), BMRC scale.
- At the time of hospital discharge: The primary outcomes measures- functional exercise capacity (6MWD, Incremental Shuttle Walk Test, 36 item Short Form Health Survey questionnaire, Berg Balance scale) were recorded under supervision of doctor and trained rehabilitation staff. Secondary end points

measured were duration of invasive mechanical ventilation and length of hospital stay.



RESULTS

A) Demographics of the study participants:

This study enrolled 82 patients of admitted over one year in Respiratory ICU of the institute. 56 individuals were male with an average age of approximately 58.54 years. The ages in this group varied, ranging from 27 to 85 years, with the middle 50th percentile of the ages falling between 52.75 and 59 years. This suggests a predominantly middle-aged to elderly male demographic represented in a standard deviation of 11.82.

The female participants comprised 26 individuals, exhibiting a lower average age of 48.35 years. The ages in the female group spanned from 21 to 75 years, with the central 50th percentile of the ages clustering between 45 and 59.25 years. This indicates a younger and more varied age distribution among the females compared to the males.

Fig. 1 represents the age range distribution by gender and Table 1 the descriptive statistics of gender. The age range among the male participants reflects a more heterogeneous sample, whereas the lower and more concentrated age range among female participants denotes a homogeneous group.

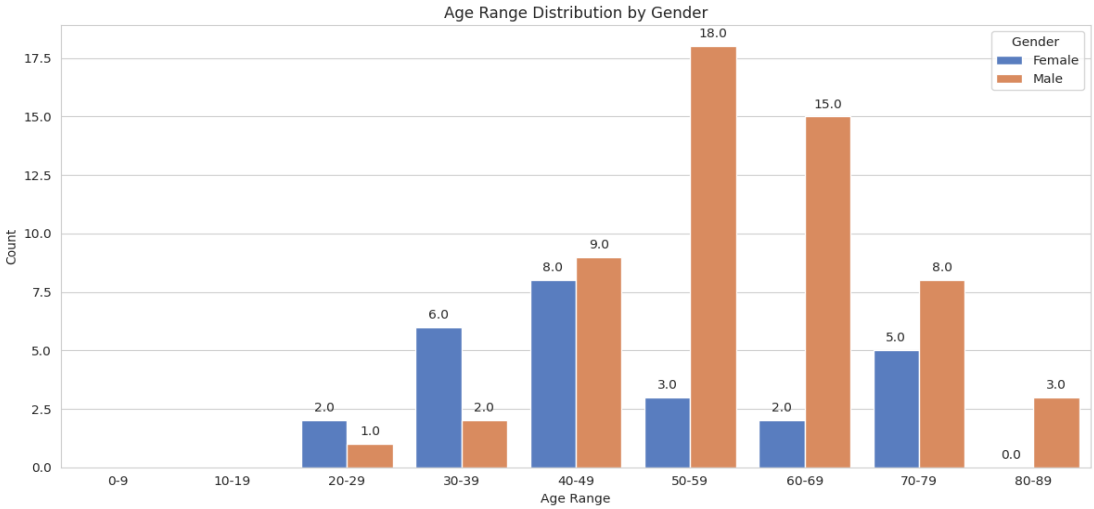


Fig 1: Age Range Distribution by Gender

	Count	Mean	Std Dev	Min	25%ile	50%ile	75%	Max
Male	56	58.535714	11.821343	27	52.75	59	65.5	85
Female	26	48.346154	16.037312	21	38.25	45	59.25	75

Table 1 Descriptive Statistics of Gender

In the table presented (Table 2), we studied the characteristics of three parameters: age, BMI/IBW, and smoking status. The average age of the participants was 55.3 years, with the youngest participant being 21 years and the eldest participant being 85. A considerable spread in age is visible, with a standard deviation of 14.03. The median age is 56, indicating that the data set is mildly skewed towards the younger population. (Fig 2). The Body Mass Index (BMI/IBW), averages 25.18 and with a standard deviation of 4.61. With the majority of participants having a BMI/IBW in the range of 22 to 28, the data is clustered around the average. (Fig. 3)

	Count	Mean	Std Dev	Min	25%ile	50%ile	75%	Max
AGE	82	55.304878	14.036715	21	45	56	64.75	85
BMI/IBW	82	25.182927	4.61	16	22	24.25	28	45
SMOKING INDEX	82	201.34146	243.23317	0	0	125	350	800

Table 2 Descriptive statistics of age, BMI, Smoking index

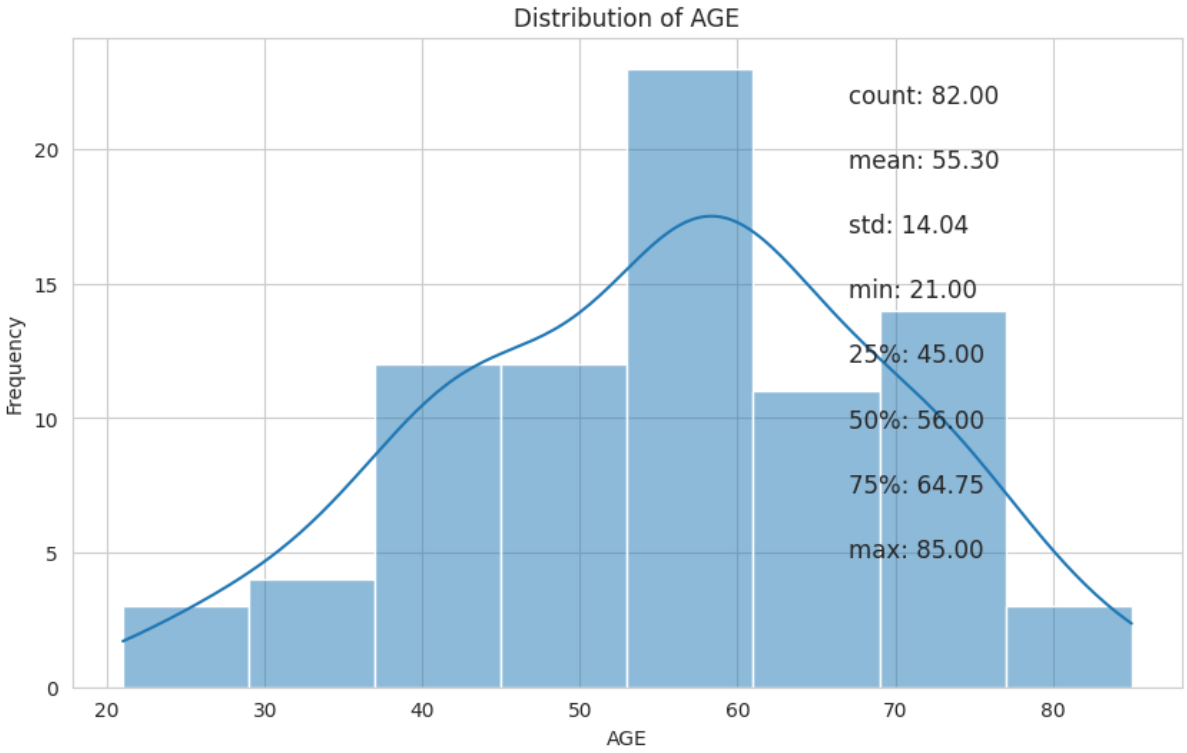


Fig. 2: Distribution of Age of the participants

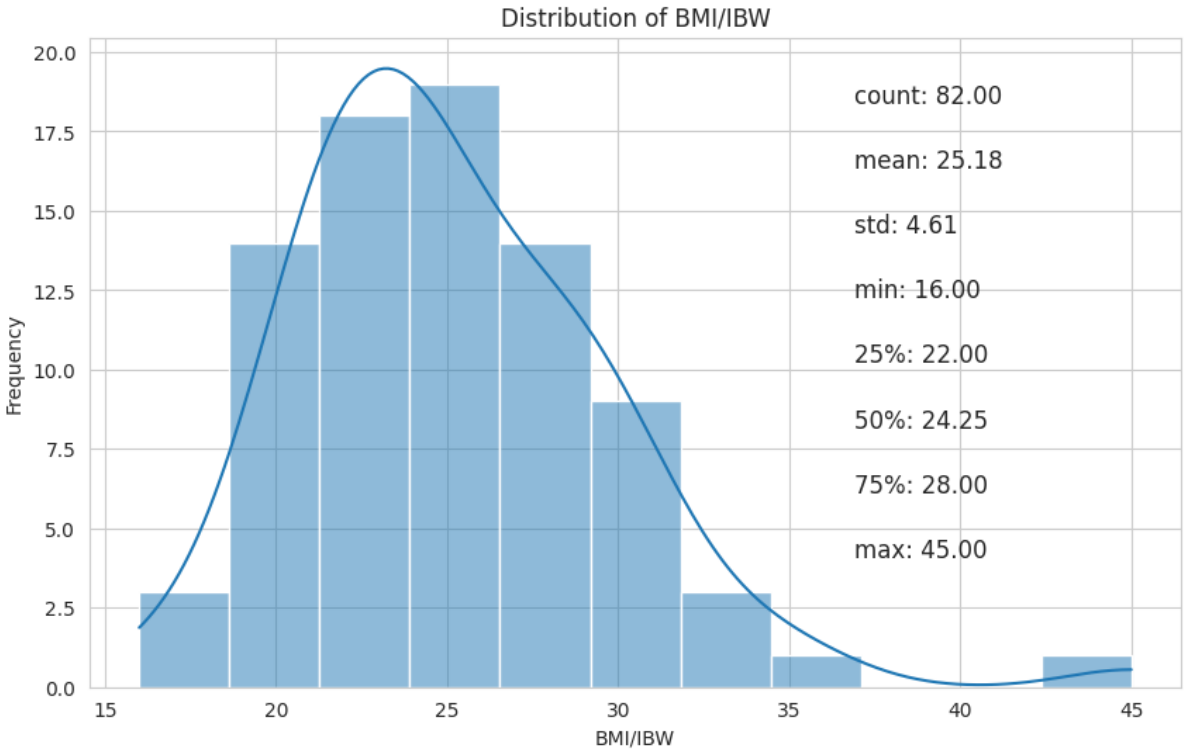


Fig 3 Distribution of BMI/IBW

The prevalent smoking exposure and population distribution within the Smoking Index range were studied. Table 2 and Fig. 4, 5 provides insights into the prevalent smoking behaviours, aiding in the identification of patterns and variability in smoking exposure within the study population. All the smokers were males. The smoking index had a mean of 201.34 and a high standard deviation of 243.23, the spread of the data is extensive compared to the participants, this is likely due to current smokers with an average smoking index of 470, and ex-smokers having an average of 249.05, while the non-smokers have 0 as shown in the figure 4. The median resting at 125 suggests a positively skewed distribution. This highlights the variance in smoking habits, from non-smokers to heavy smokers reaching up to an index of 800.

The relationships between age, BMI/IBW, and smoking Index were studied as shown in the pair plot Fig 5. The average age of the participants was 55 years, and most had a standard BMI of around 25. However, there was a broad range in the Smoking Index, with a notable high value of 800, indicating varied smoking patterns among the study participants.

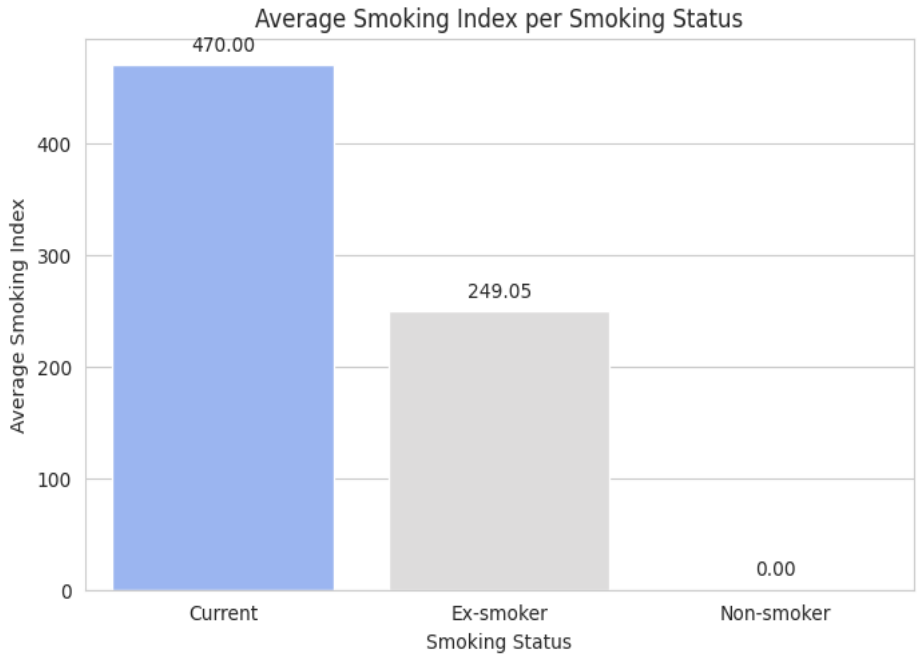


Fig 4 Average smoking index per patient

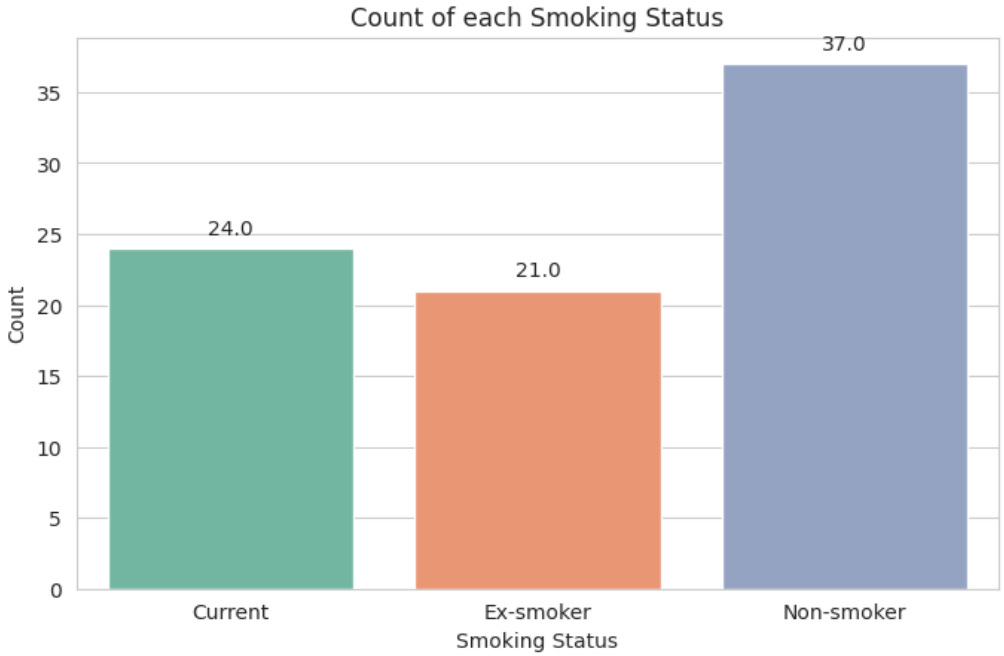


Fig: 5 Smoking status of the participants

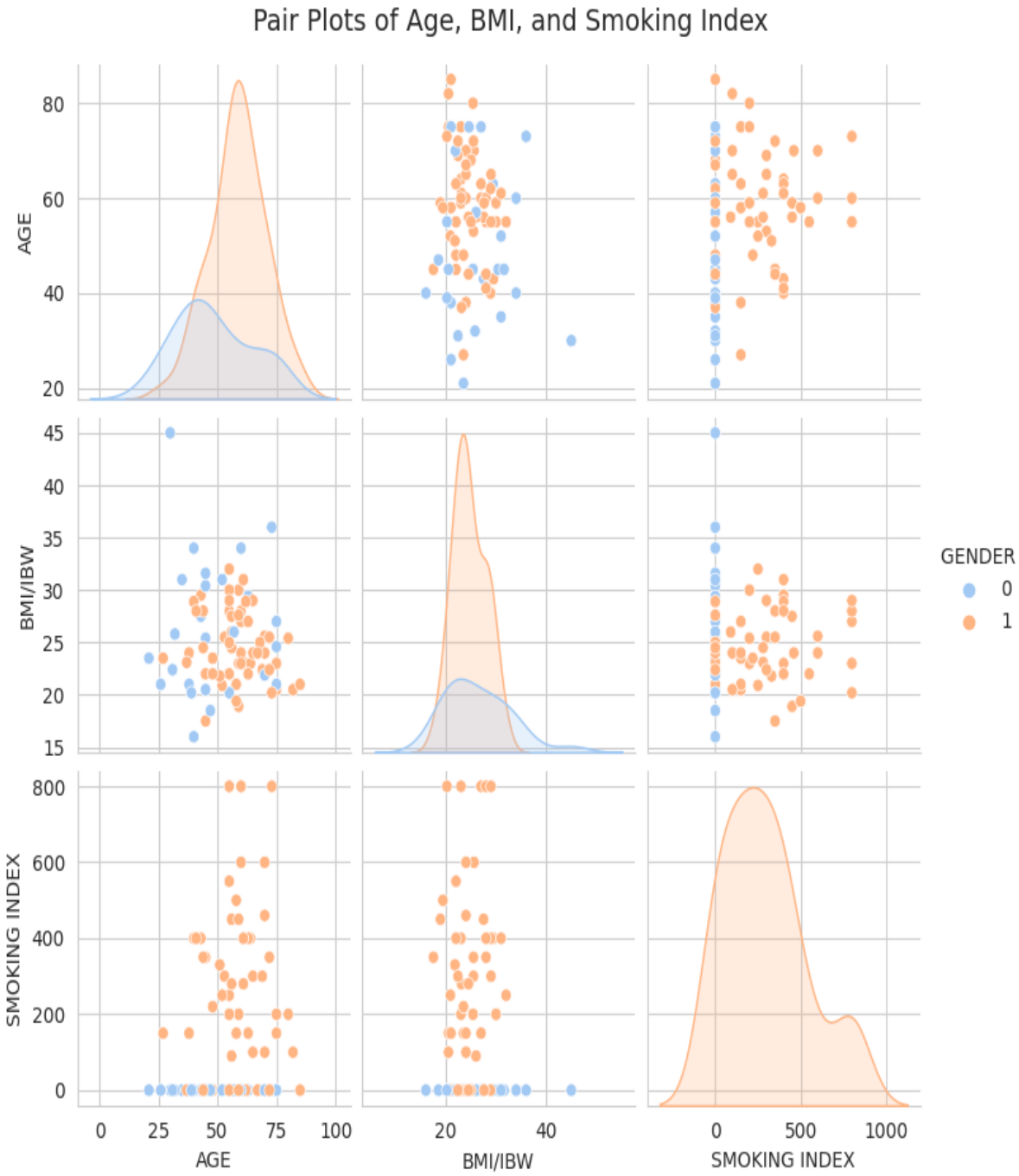


Fig 6 Pair plot of age, BMI and smoking index

B) Analysis of the Comorbidities in the study population:

Metabolic comorbidities

Our study aimed to understand how often different comorbidities (occurrence of multiple metabolic co-morbidities existed) occurred together in the study population. The heatmap (Fig 7). colour shades showed the presence of different metabolic comorbidities in the same patient. Here's a simple breakdown of what we found:

Obesity and Diabetes Mellitus (DM): The colour shade in the graph where Obesity and Diabetes meet is quite light. This suggests that among the patients we studied, having obesity alongside diabetes is relatively common.

Obesity and Systemic Hypertension: Similar to Diabetes, the occurrence of Systemic Hypertension along with Obesity is also common as indicated by the light shade in the graph.

Systemic Hypertension (SHTN) and Diabetes (DM): The graph also shows a lighter shade where Hypertension and Diabetes meet, which means many study participants who have hypertension also have diabetes.

Individual Conditions: Looking at where the names of the conditions meet themselves on the graph (for example, Obesity and Obesity), we see different shades. This gives an idea of how common each individual condition is among our participants.

Other Conditions: The other health conditions we studied, including Thyroid conditions, CAD, and Renal Failure, also showed varying degrees of occurrence together, but they were not as commonly found together as Obesity, Hypertension, and Diabetes.

Heatmap of the overlap between the metabolic co-morbidities: Findings noted (Fig 7)

This analysis provides insights into the concurrence of different metabolic comorbidities in the study population. The highest overlap is observed within the same comorbidities, such as 51% for Obesity and Obesity, 47% for SHTN (Systemic Hypertension) and SHTN, and 31% for renal failure and renal failure. This is expected as it shows the prevalence of each condition in the filtered dataset. It's noteworthy that Obesity and SHTN share a 22% overlap, suggesting that a significant proportion of patients who are obese also have SHTN.

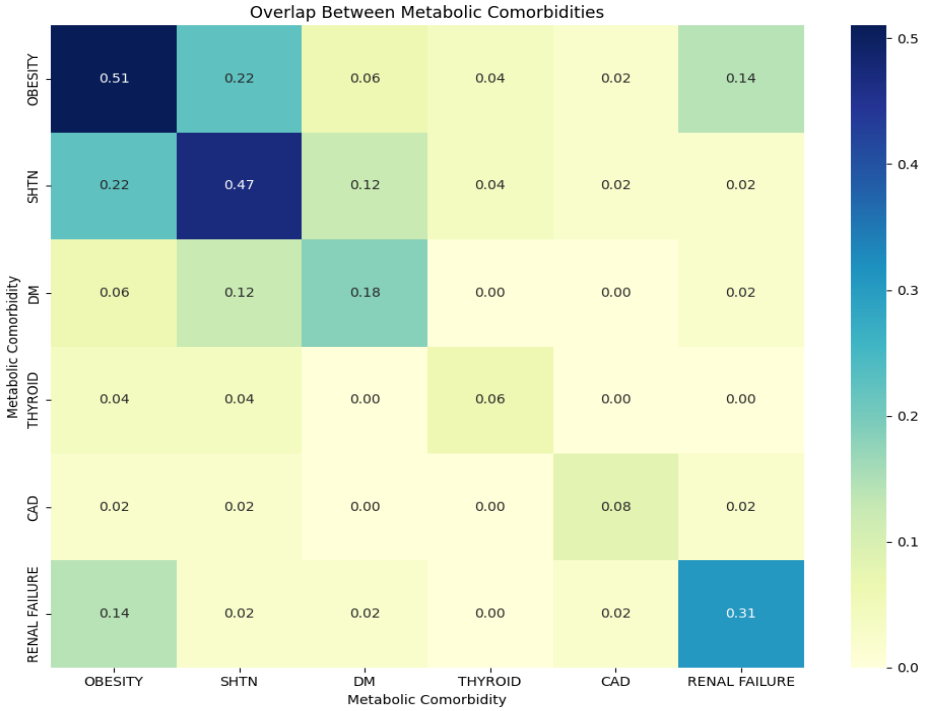


Fig 7 Heatmap of the overlap between the metabolic co-morbidities

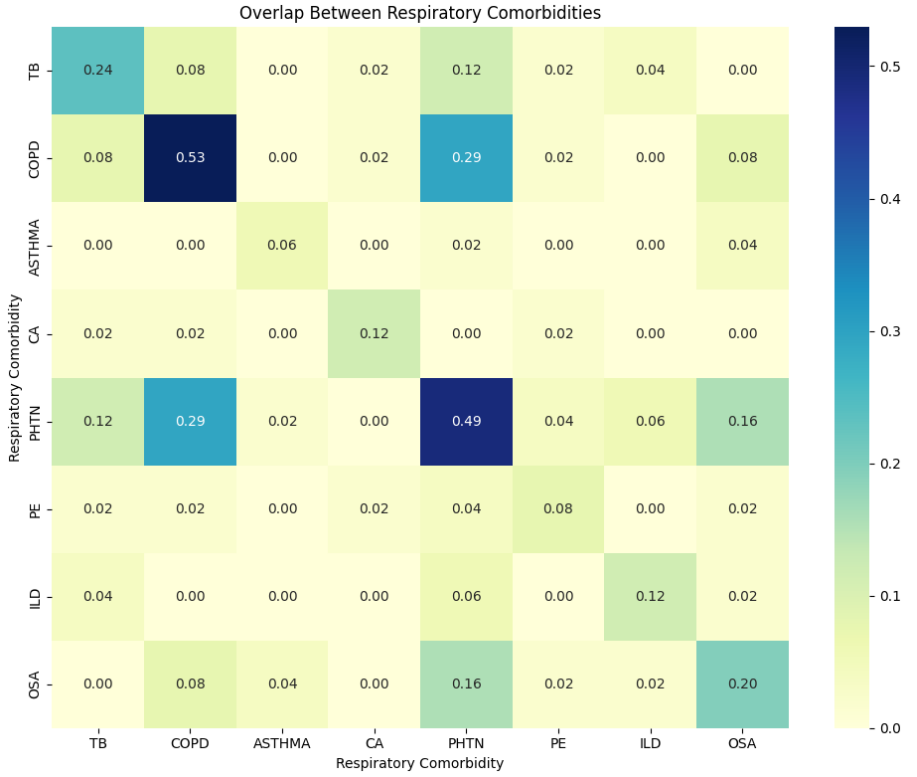


Fig 8 Heatmap of the overlap between respiratory comorbidities

Diabetes Mellitus (DM) has relatively low overlaps with other comorbidities like Obesity (6%) and SHTN (12%). However, it's crucial to recognize that even low overlaps are significant as patients with multiple comorbidities often have varied clinical outcomes.

Other comorbidities like Thyroid disorders and Coronary Artery Disease (CAD) exhibit very low overlaps with the rest of the conditions, suggesting less common concurrence within the patient population under study.

Respiratory comorbidities

Analysing the heatmap representing the overlap of various respiratory conditions (shown in Fig 8)

- Tuberculosis (TB) has a significant overlap with Chronic Obstructive Pulmonary Disease (COPD) and Pulmonary Hypertension (PHTN) at 8% and 12% respectively.
- COPD shows substantial overlap with PHTN, being present together in 29% of cases studied.
- Asthma has a minimal overlap with other respiratory conditions, with the highest being 4% with Obstructive Sleep Apnea (OSA).
- Lung Carcinoma (CA) has a more distributed overlap with other conditions, with the maximum overlap being 12% with itself, indicating the possibility of multiple carcinoma occurrences.

- PHTN has the highest overlap with itself at 49%, and substantial overlaps with COPD and OSA, suggesting it often occurs alongside these conditions.
- Pulmonary Embolism (PE) demonstrates a moderate overlap with itself at 8%, with minimal overlaps with other conditions.
- Interstitial Lung Disease (ILD) has a 12% overlap with itself and minor overlaps with other conditions.
- OSA (Obstructive Sleep Apnea) shows a 20% overlap with itself and significant overlaps with PHTN and COPD at 16% and 8% respectively.

This analysis reflects the overlap of respiratory conditions. PHTN, in particular, seems to coexist with several other conditions, notably COPD and OSA, indicating it may share common risk factors or pathological pathways with these disorders. The substantial overlap of conditions like PHTN and COPD with themselves may suggest the presence of multiple manifestations or complications of these conditions in the studied population. Meanwhile, the low overlap of conditions like Asthma and ILD with others may suggest distinct etiological pathways.

C) On ICU admission

Admission diagnosis

The analysis of different diagnoses on ICU admission is presented using a heatmap in Fig 9 representing the overlap of a diagnosis with itself, essentially depicting the proportion of cases where the condition occurs, either isolated or not accompanied by any of the other listed diagnoses.

Acute Exacerbation of COPD (AECOPD): About 40% were found to have AECOPD, and 15% have been diagnosed with TB self-overlap without a concurrent diagnosis of the other conditions listed in the table suggesting these have higher prevalence that occurred independently within the studied demographic.

Pneumothorax: A 4% overlap for pneumothorax indicates a lower occurrence along with its lower overlap with other conditions, indicating it usually occurs independently or is less frequently diagnosed in conjunction with the listed diagnoses.

The following are the findings of the overlap of different conditions with each other Fig 9

- Septic Shock and AECOPD had a 12% overlap with each other
- ILD and CA Lung: The 8% and 14% self-overlap respectively, along with their lower overlaps with other conditions, highlight their more independent occurrence.

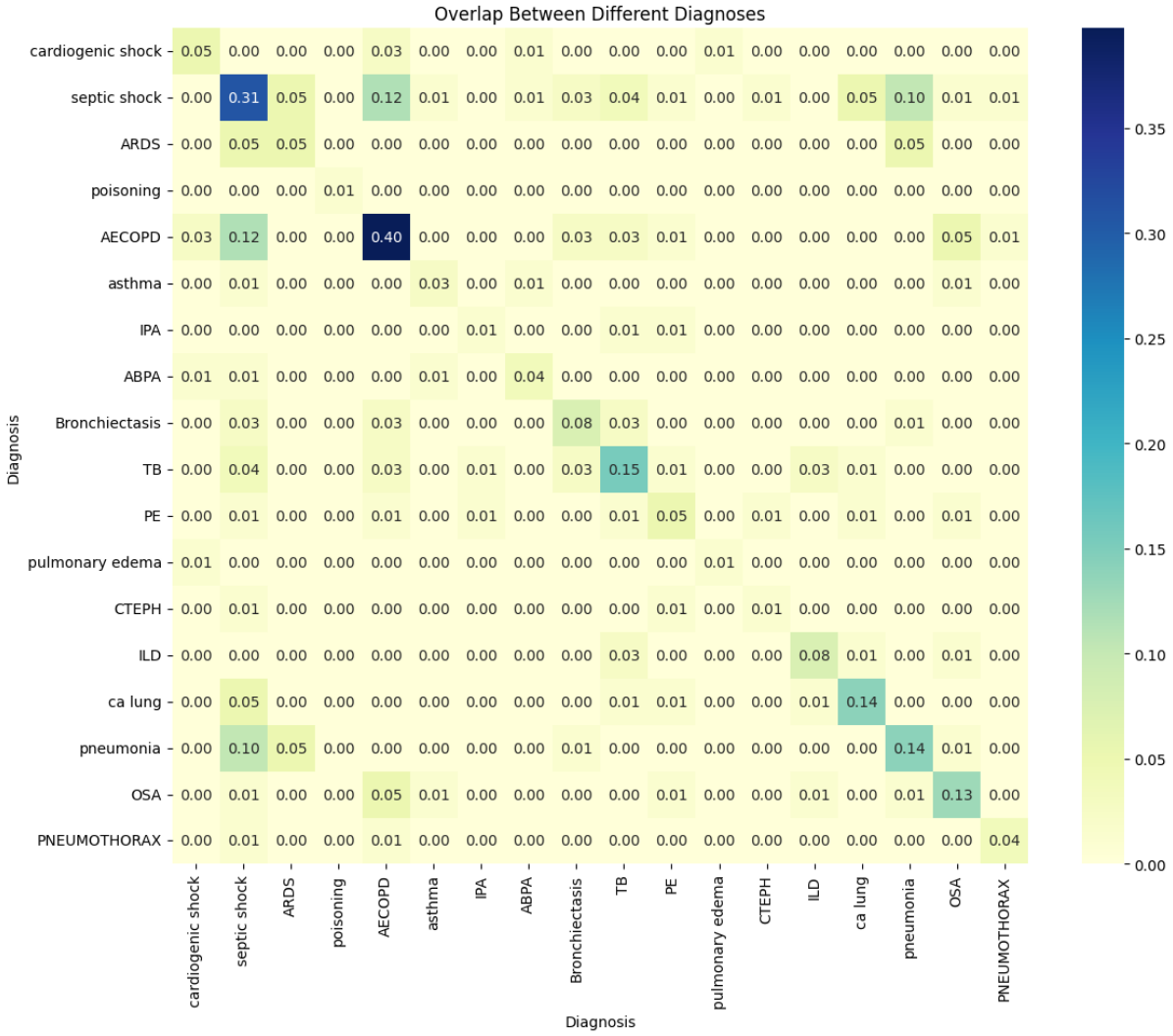


Fig 9: Heatmap of the overlap between different ICU admission diagnoses

Overview of Study Variables on admission

In this analysis, various clinical variables on ICU admission were analysed as shown in Table 3. Clinical variables included: APACHE II score, mode of ventilation.

Descriptive statistics of APACHE II on admission

Table 3: Distribution of APACHE II on admission

APACHE II at admission	Total (n=82)
<5	2 (2.4%)
6 TO 10	3 (3.7%)
11 TO 15	15 (18.3%)
16 TO 20	29(35.4%)
21 -25	31(37.8%)
>25	1(1.2%)

In our study the majority of patients, 35.4%, had an APACHE II score ranging from 16 to 20, followed closely by 37.8% with scores between 21 to 25. This distribution indicates that a significant proportion of the patients had moderate to high severity at admission. On the lower and higher ends of the scale, 2.4% of patients had scores below 5, and 1.2% exceeded 25. The average APACHE II score was 18.47, with a standard deviation of 4.80, indicating moderate variability in the severity of illness among the patients. (Fig 10)

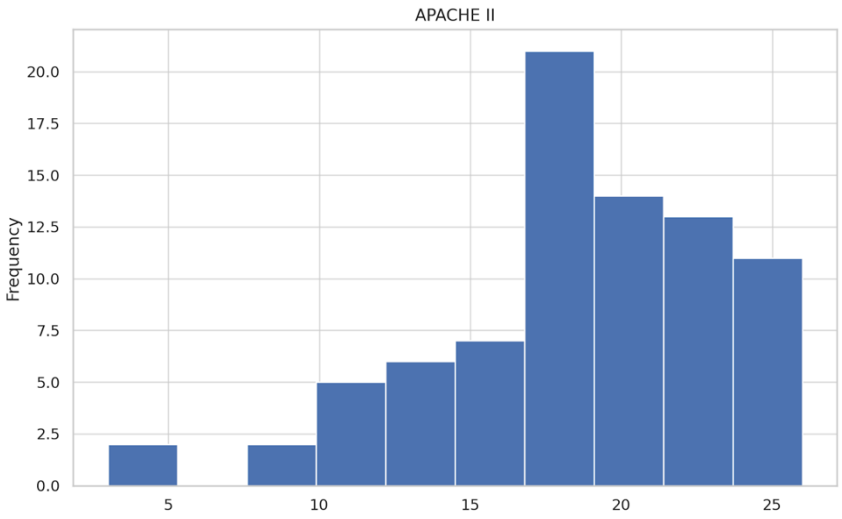


Fig 10: Distribution of APACHE II on admission

Mode of ventilation among ICU admissions:

Table 4: Mode of ventilation among ICU admissions

Mode of ventilation	Number	Percentage (%)
Face mask	6	7.3
HFNC	1	1.2
IMV	29	35.4
nasal prongs	5	6.1
NIV	37	45.1
NRBM	2	2.4
Room air	2	2.4

45.1% of patients were given Non-Invasive Ventilation (NIV)and 35.4% of patients received Invasive Mechanical Ventilation (IMV). Face masks and nasal prongs were used for 7.3% and 6.1% of patients, respectively. High Flow Nasal Cannula (HFNC) was used in 1.2% of cases. 2.4% of patients each were on NRBM and on room air. (Table 4, Fig. 11)

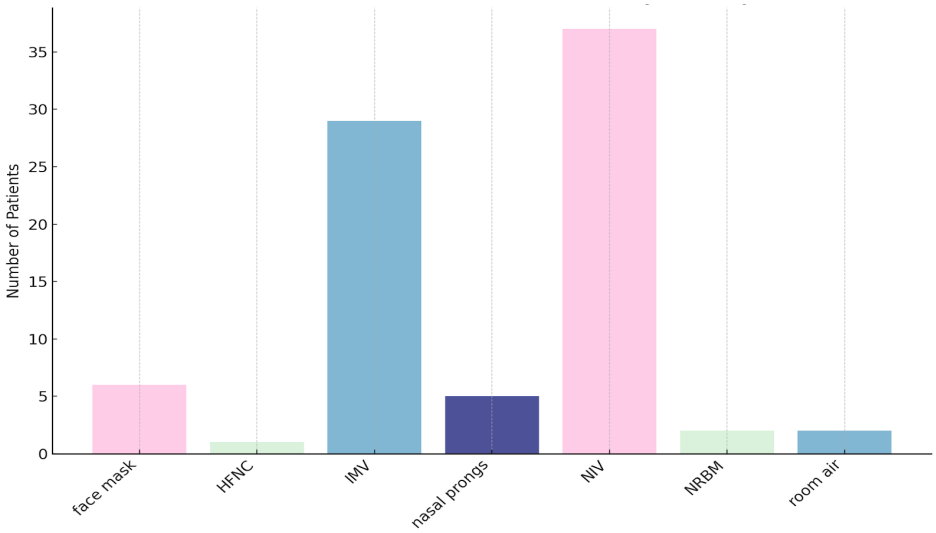


Fig 11: Mode of ventilation among ICU admissions

D) During the ICU course

In this analysis, treatment-related variables on ICU admission were analysed as shown in Table 5 and 6. Treatment-related variables included the receipt and duration of drugs such as steroids, sedation, neuromuscular blockers, and vasopressors.

Treatment variables during the ICU course

Table 5: Treatment variables received during ICU stay

Variable	Frequency and Percentage
Steroids received	55 (67.07%)
Sedation received	29 (35.37%)
Neuromuscular blocker received	17 (20.73%)
Vasopressors received	28 (34.15%)

Drugs received: A significant proportion of subjects received steroids (67.07%), sedation (35.37%), and vasopressors (34.15%), while 20.73% received neuromuscular blockers.

Treatment variables during the ICU course: Mean duration

Table 6: Duration, mean dose of treatment variables during the ICU course

Variable	Mean	Standard Deviation
Steroid days	3.29	2.83
Sedation days	1.80	3.90
Neuromuscular blocker days	0.70	1.65
Vasopressor days	1.16	2.06
Mean steroid dose mg/IMV days	18.36	60.00
Mean fentanyl dose mcg/IMV days	225.92	375.89
Mean midazolam dose mg/IMV days	22.15	37.58
Mean neuromuscular blocker dose mg/IMV days (vecuronium)	3.95	12.11

Duration of drugs received: The subjects, on average, received steroids for 3.29 days, sedation for 1.80 days, neuromuscular blocking agents (NMB) for 0.7 days and vasopressors for 1.16 days.

Mean drug doses per IMV days: The average doses of drugs such as steroids, fentanyl, midazolam, and vecuronium varied, with notable variability in each, as indicated by the respective standard deviations.

Treatment variables: Duration

Among the treatment variables (as shown in Fig.12,13), most patients received steroids, vasopressors and sedation, for a mid-range duration of 3-6 days. In contrast, for NMB, the majority had a shorter duration of 0-2 days.

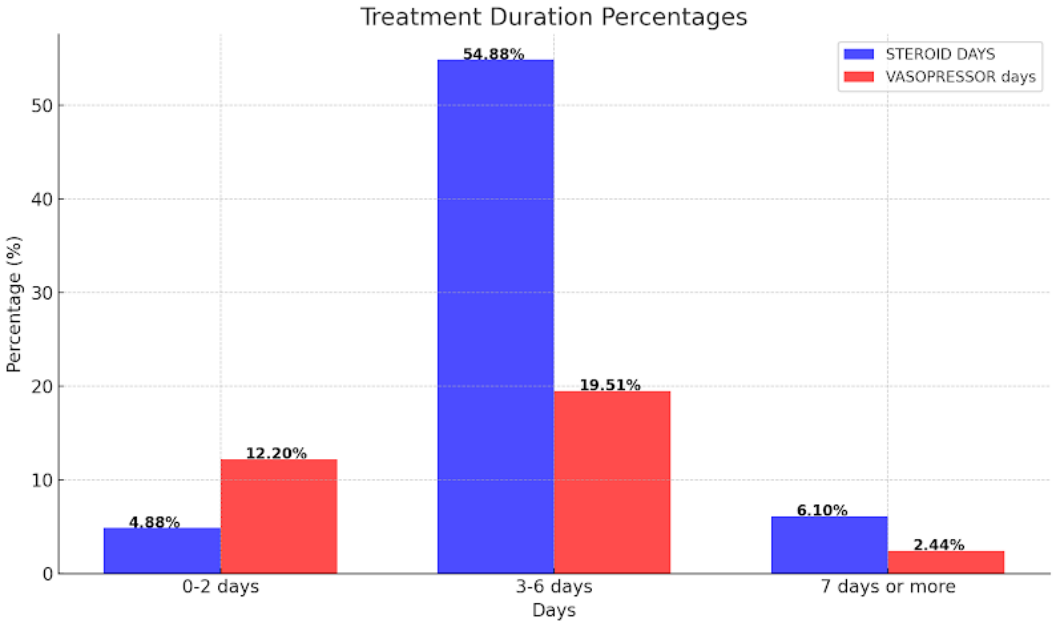


Fig.12: Distribution of duration of Steroids and vasopressor

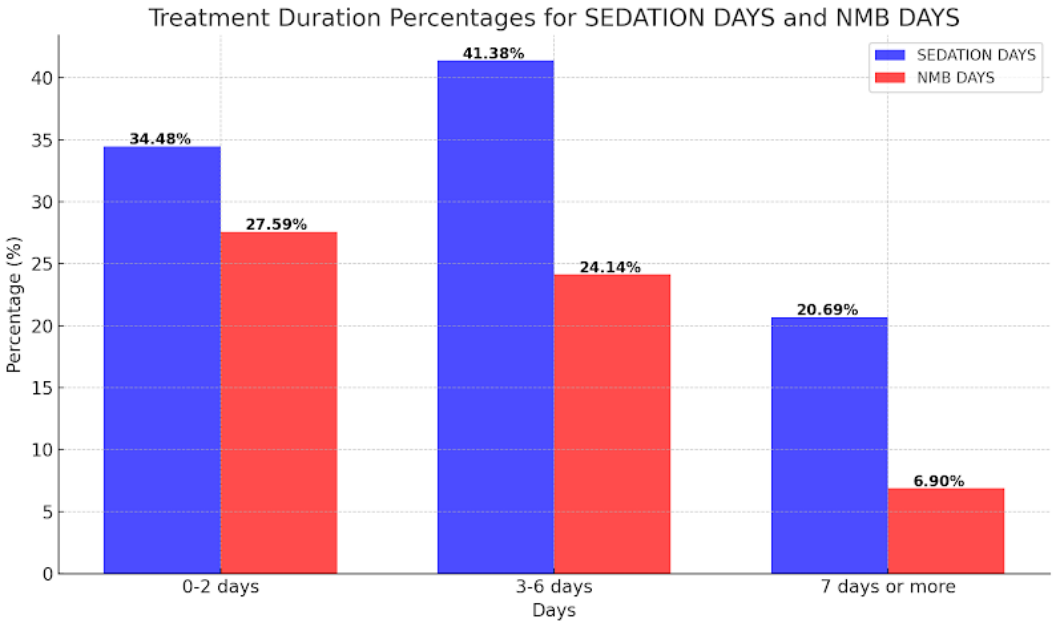


Fig 13: Distribution of duration of sedation and Neuromuscular blockers

E) Overview of Study Variables at Spontaneous Breathing Trial (SBT)

This analysis investigates clinical parameters taken at the point of the Spontaneous Breathing Trial (SBT) in 29 intubated patients, focusing on the diaphragm thickness (SBT-DT), the British Medical Research Council score (SBT-BMRC), hand grip strength (SBT-Hand grp), and quadriceps strength (SBT-Quadriceps strength). Variables assessed are presented in table 7.

Descriptive Statistics of Continuous Variables at SBT

Table 7: Descriptive Statistics of Continuous Variables at SBT

Variable	Mean	Standard Deviation
SBT-Diaphragm Thickness	2.02	0.17
SBT-BMRC	32.44	17.26
SBT-Handgrip	10.99	6.92

- *Diaphragm Thickness (SBT-DT):* The average diaphragm thickness at SBT was approximately 2.02, with a relatively small standard deviation of 0.17
- *BMRC Score (SBT-BMRC):* The average BMRC score was approximately 32.44, with a standard deviation of 17.27, reflecting a substantial variability in muscle strength among the patients.
- *Hand Grip Strength (SBT-Hand grip):* The subjects showed an average hand grip strength of approximately 10.99, with a standard deviation of 6.92. (Table 7)

SBT – Diaphragm Strength

Table 8: Distribution of SBT-Diaphragm thickness:

SBT Diaphragm thickness	Number	Percentage
<2 mm	14	56%
>2 mm	11	44%

At the time of SBT, 56% of the intubated patients had a diaphragm thickness of 2mm or less and 44% of them had a value greater than 2mm. This distribution indicates that more than half of the patients had SBT-diaphragm thickness of 2 mm or less. (Table 8)

SBT - BMRC

Table 9: Distribution of SBT-BMRC

BMRC	Number	Percentage
<48	24	88.8%
>48	3	11%

At the time of SBT, about 89% of intubated patients had SBT-BMRC value of 48 or less indicating ICU acquired weakness. And approximately 11% of the samples had an SBT-BMRC value greater than 48. (Table 9)

SBT - Handgrip Strength

Table 10: Distribution of SBT-Handgrip strength:

Handgrip strength	Number	Percentage
<11	14	51.8%
>11	13	48.14%

SBT-Handgrip: Nearly 52% of the intubated patients had an SBT-handgrip strength of 11 or less indicating weakness and about 48% of the them had a value greater than 11. in intubated patients. (Table 10)

SBT -Quadriceps Strength

Table 11: Distribution of quadriceps muscle strength

SBT-Quadriceps strength	**Percentage**	**Frequency**
0	17.24%	5
2	6.90%	2
3	37.93%	11
4	31.03%	9
5	0%	0
Not available (NA)	6.90%	2

The majority of patients had quadriceps strength grade of 3 (37.93%) or 4 (31.03%), suggesting that a significant portion of the sample demonstrated weakness in the quadriceps muscle. None of the patients achieved the highest strength score of 5. (Table 11)

F) Analysis of Variables of all patients at ICU Discharge

Analysis of Variables of all patients at ICU Discharge

This study provides insight into clinical variables recorded at the point of ICU discharge of patients. These variables include the number of days spent in the ICU (ICU days), the number of days on invasive mechanical ventilation (IMV days), the discharge BMRC (D-BMRC) score, the discharge handgrip strength (D-handgrip), and the discharge quadriceps strength (D-quadriceps strength).

Analysis of ICU discharge as Continuous Variables

Table 12: ICU discharge parameters

Variable	Mean	Standard Deviation
ICU days	8.43	5.32
IMV days	2.53	5.14
D-BMRC	55.75	5.29
D-Handgrip	23.19	5.76

- ICU Days: On average, patients spent approximately 8.43 days in the ICU, with a standard deviation of 5.32 days
- IMV Days: The average duration of invasive mechanical ventilation for patients was approximately 2.53 days, with a standard deviation of 5.14 days
- Discharge-BMRC Score: The average D-BMRC score was approximately 55.75, with a standard deviation of 5.29, suggesting a close clustering of scores around the mean.
- Discharge-Handgrip Strength: The average D-hand grip strength was found to be approximately 23.19, with a standard deviation of 5.76, illustrating variability in the muscular strength of patients muscle strength at the point of ICU discharge. (Table 12)

Descriptive Statistics of Discharge-IMV days

Mean: 7.07 days

Among the 29 intubated patients, 48.28%, of patients required invasive mechanical ventilation for a duration of 3 to 6 days. Those requiring it for 1-2 days or on prolonged mechanical ventilation (7 days or more) are comparatively fewer, accounting for 17.24% and 34.48% respectively. (Fig. 14)

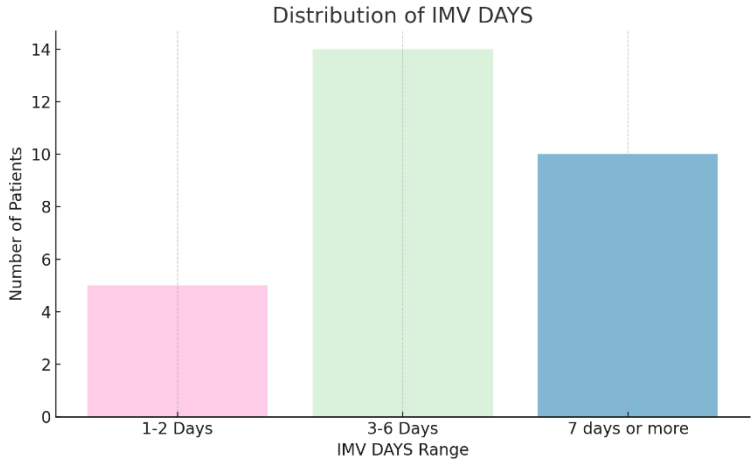


Fig.14: Distribution of IMV days

Descriptive Statistics of Discharge-ICU days

The duration of ICU stay for patients is distributed as follows: majority (69.5%) stayed in the ICU for 7 days or longer. 29.3% of patients had a stay duration of 3-6 days and only a small fraction (1.2%) had a stay of 1-2 days. (Fig 15)

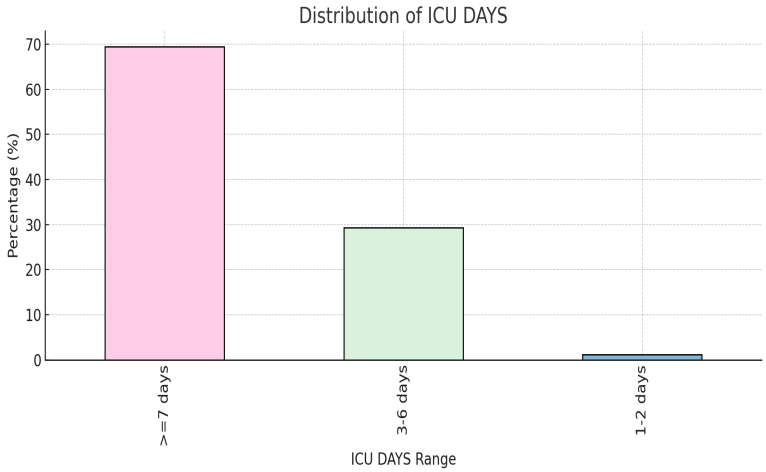


Fig.15: Duration of ICU stay

Descriptive Statistics of Discharge-BMRC

Table 13: Discharge- BMRC distribution

D-BMRC Range	Count	Percentage (%)
>=48	66	94.29
<48	4	5.71

The majority of patients (94.3%) had a D-BMRC value of 48 or higher. Only a small percentage (5.7%) had values less than 48 indicating ICU acquired muscle weakness. (Table 13)

Descriptive Statistics of Discharge-Handgrip

Table 14: Discharge handgrip distribution

Discharge Handgrip	Number	Percentage (%)
>11	69	98.57%
<11	1	1.43%

Almost all patients (98.6%) had a D-HAND GRIP value of 11 or higher, suggesting that the majority of patients had good hand grip strength. Only a small fraction (1.4%) had values less than 11. (Table 14)

Descriptive Statistics of Discharge-Quadriceps Strength

Table 15: Discharge quadriceps strength distribution

Discharge-Quadriceps strength	**Frequency**	**Percentage (%)**
5	42	60%
4	26	37.14%
3	2	2.86%

A majority of patients (60%) had a Discharge-Quadriceps Strength score of 5, 37.14% had a score of 4, and a small proportion (2.86%) had a score of 3. (Table 15)

The analysis states the varied recovery profiles of patients exist at ICU discharge as reflected in the diverse range of ICU days, IMV days, and scores in respiratory and muscular assessments.

G) Analysis of Hospital Outcome Variables

ICU Outcome

- Among the 82 study participants, 70 subjects (85.36%) had an outcome of discharge, whereas 12 subjects (14.63%) had an outcome of death as shown in Fig.16.

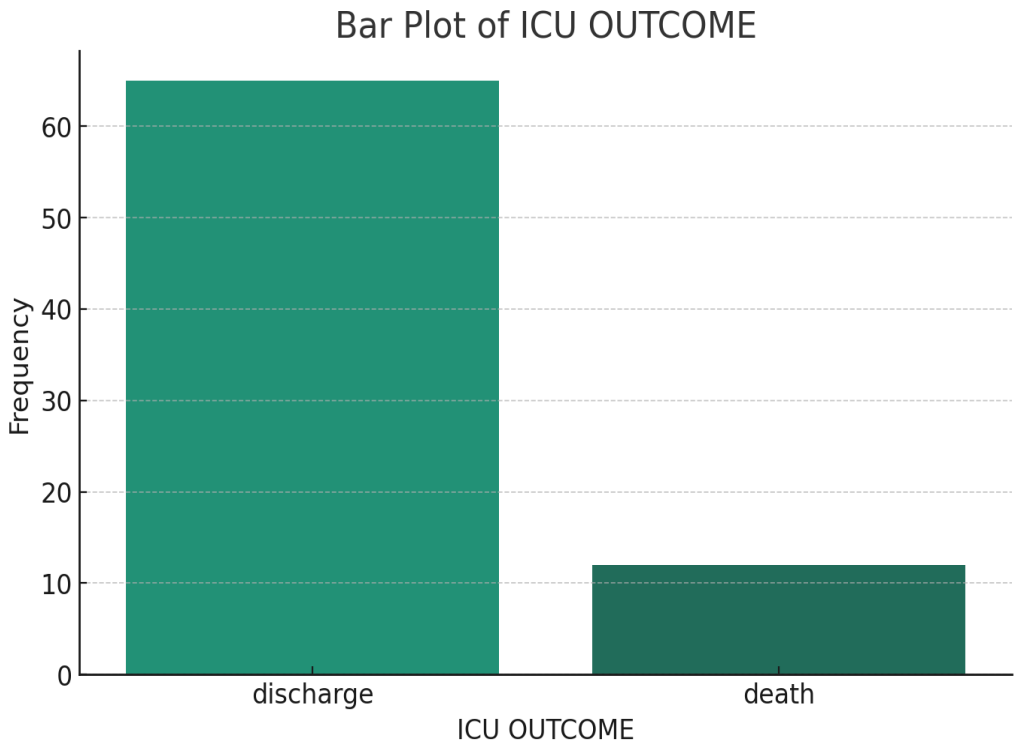


Figure 16: Bar Plot of the variable ICU outcome.

H) Overview of Outcome Variables at hospital discharge

This analysis depicts the outcome variables in 70 discharged patients at the point of hospital discharge. These variables are presented in table 16, they include the six-minute walk distance (6MWD), the Incremental Shuttle Walk Distance (ISWD), the SF-36 Health Survey score (SF 36), and the Berg Balance Scale score (Berg Balance).

Table 16: Outcome variables at hospital discharge

Variable	Mean	Standard Deviation
6MWD	241.45	108.82
ISWD	184.06	131.10
SF 36	72.67	14.06
BERG BALANCE	40.72	9.46

- Six-Minute Walk Distance (6MWD): Patients covered an average distance of approximately 241.45 meters, with a standard deviation of 108.82 meters, indicating variability in functional exercise capacity among subjects.
- Incremental Shuttle Walk Distance (ISWD): The average ISWD was approximately 184.06 meters, with a substantial standard deviation of 131.11 meters, reflecting a wide range of exercise capacity among subjects.
- SF-36 Health Survey: Subjects had an average score of approximately 72.67 on the SF-36 Health Survey, with a standard deviation of 14.07.
- Berg Balance Scale: The average score on the Berg Balance Scale was approximately 40.72, with a standard deviation of 9.46

6 Minute Walk Distance

Table 17: Distribution of the 6MWD in Meters

6MWD (meters)	N=70	Percentage %
<100	6	8.6
100-200	24	34.4
200-300	17	24.3
>300	23	32.9

The majority of the patients, 34.4% of the total covered 100-200 meters range, followed by those walking more than 300 meters, making up 32.9%, 200-300 meters comprise 24.3%. About 8.6%, had a 6-minute walking distance of less than 100 meters. (Fig. 17)

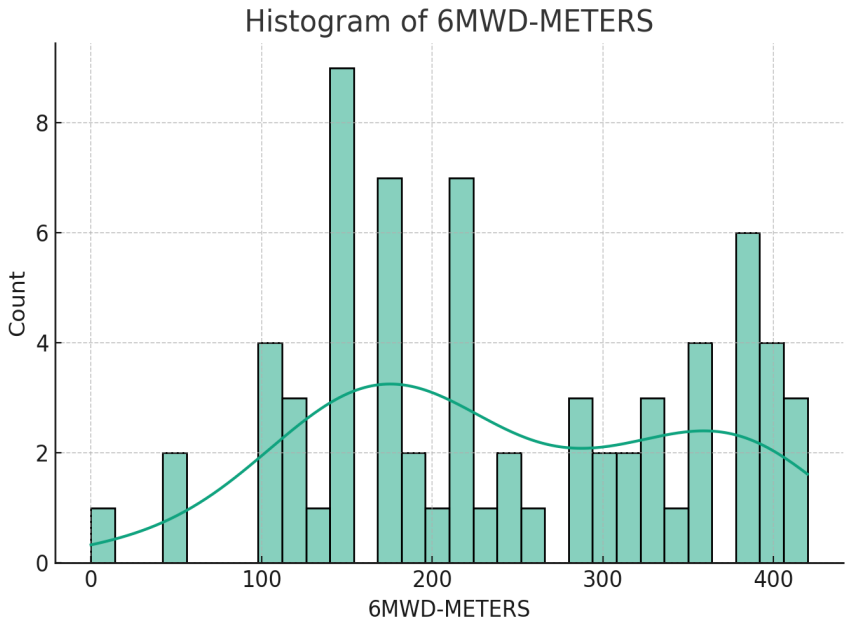


Fig 17: Histogram of the variable 6MWD.

Incremental Shuttle Walk Distance (ISWD)

Table 18: Distribution of the ISWD

ISWD (meters)	N=70	Percentage %
0	7	10
<100	10	14.3
100-200	28	40
200-300	14	20
300-400	8	11.4
>400	3	4.3

The most substantial group, accounting for 40% of the patients, falls within the 100-200 meters range. This is followed by 20% of patients walking between 200-300 meters, 14.3% of patients have an incremental shuttle walk distance of less than 100 meters, 11.4% walk between 300-400 meters. A smaller proportion, 10%, have a distance of 0 meters. The smallest group, at 4.3%, walk more than 400 meters. (Fig.18)

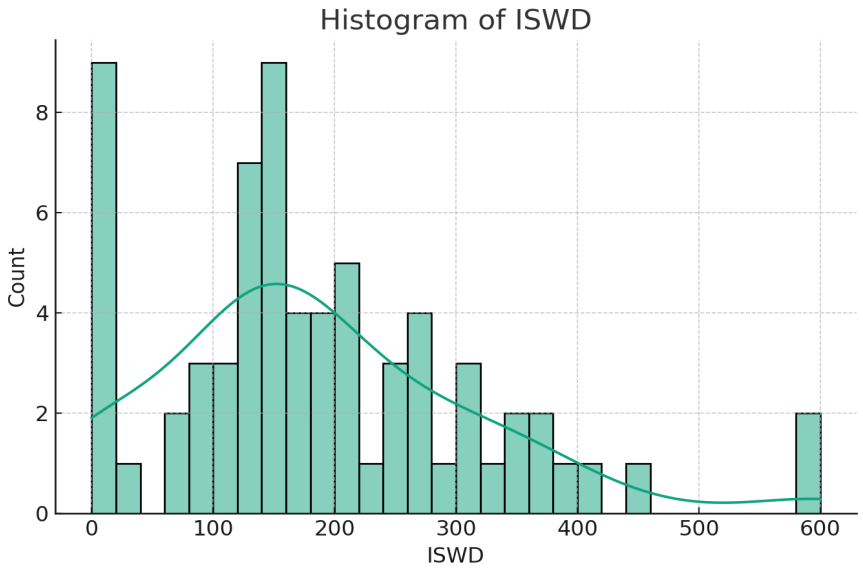


Figure 18: Histogram of the variable ISWD.

SF-36 score

Table 19: Distribution of the SF-36 scores

SF 36 score	N=70	Percentage %
<50	2	2.9
50 - 75	33	47.1
>75	35	50

Half of the patients (50%) have SF 36 scores greater than 75. A significant proportion, 47.1%, have scores ranging between 50 to 75. Only a small fraction, 2.9%, have scores below 50. (Fig.19)

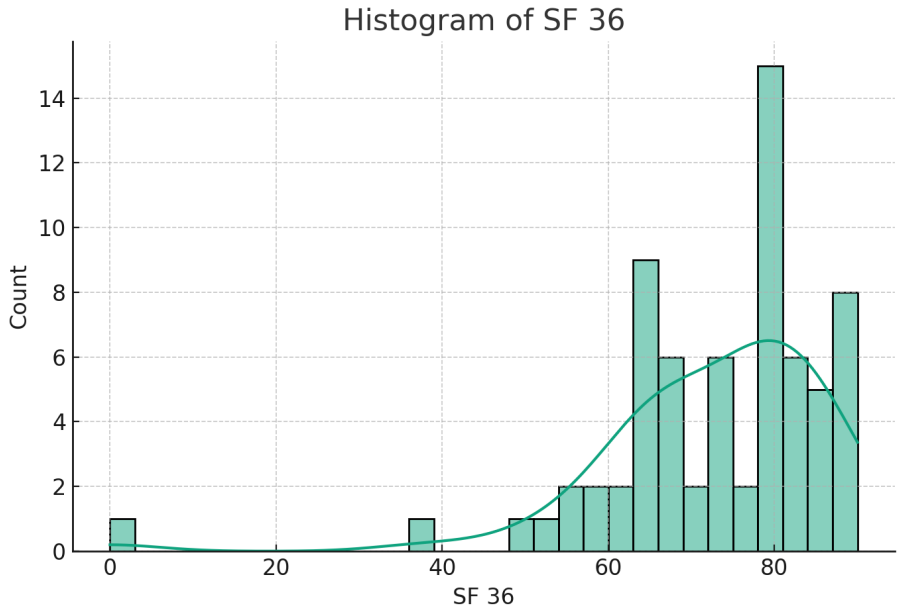


Figure 19: Histogram of the variable SF 36.

Berg Balance Scale

Table 20: Distribution of the Berg Balance scale

Berg Balance Score	N=70	Percentage (%)
<30	8	11.4
31-40	28	40
41-50	27	38.6
>50	7	10

At hospital discharge, most patients had Berg Balance score of between 31-40, accounting for 40% of the total. This is closely followed by those scoring between 41-50, which constitutes 38.6%. Fewer patients, 11.4%, score less than 30. An equal percentage of patients, 11.4%, score more than 50. (Table 20, Fig.20)

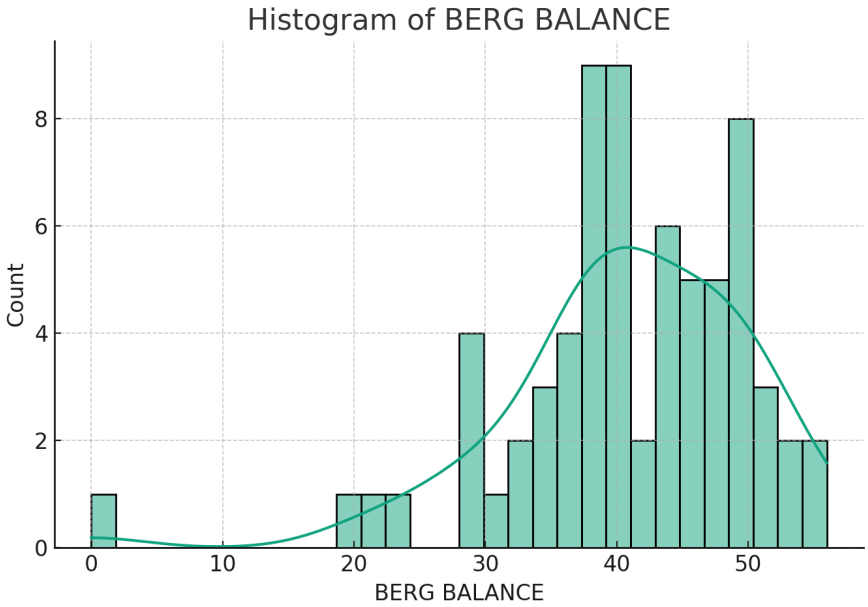


Figure 20: Histogram of the variable Berg Balance

H) ICU and Hospital Outcome Analysis

Age and Gender

This report presents an analysis of ICU outcomes based on data that includes patient's age, gender, and ICU outcomes. The objective is to determine if there are statistically significant relationships between the ICU outcomes and the age or gender of patients.

Statistical Test Results

Table 21: P-values from Statistical Tests

Test	P-value
Age vs ICU outcome	0.022
Gender vs ICU outcome	0.33

Frequency Distributions

Age and ICU Outcomes:

The p-value of 0.022 for the relationship between age and ICU outcome is statistically significant ($p < 0.05$). This suggests that age plays a role in determining ICU outcomes, either death or discharge (Table 21). The frequency distribution further illustrates this trend (Fig.21). For the age groups 21-40 and 41-60, there's a higher number of discharges as compared to deaths. The 61-80 age group shows a similar pattern, which might suggest that age alone isn't a primary determinant of ICU outcome.

Gender and ICU Outcomes:

The p-value of 0.33 for the relationship between gender and ICU outcome is not statistically significant ($p > 0.05$). This indicates that there's no strong evidence, based

on this dataset, that gender directly impacts whether a patient is discharged or succumbs in the ICU (Table 21). The frequency distribution supports this observation (Fig. 22), showing that while there are more males than females in both the 'death' and 'discharged' categories, the proportions of outcomes within each gender group don't vary drastically.

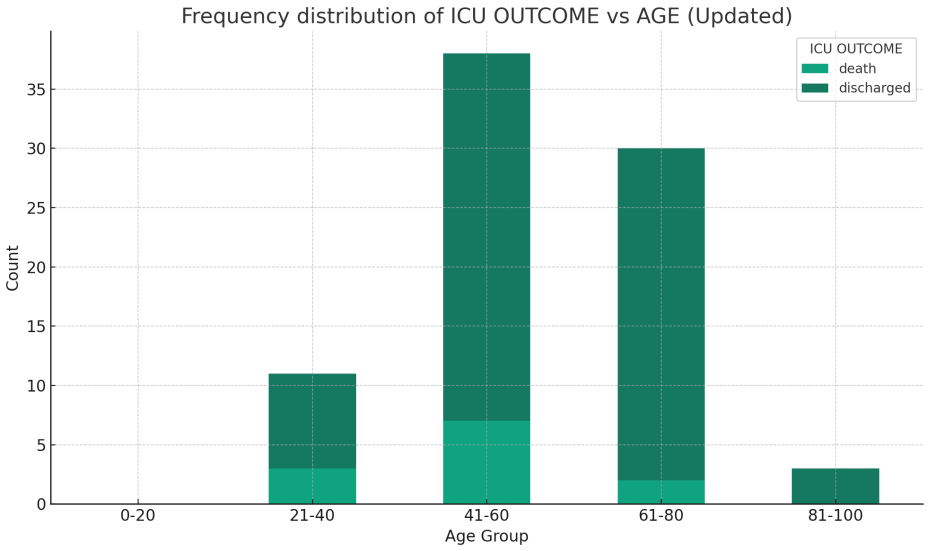


Figure 21: Bar chart of ICU outcome vs age

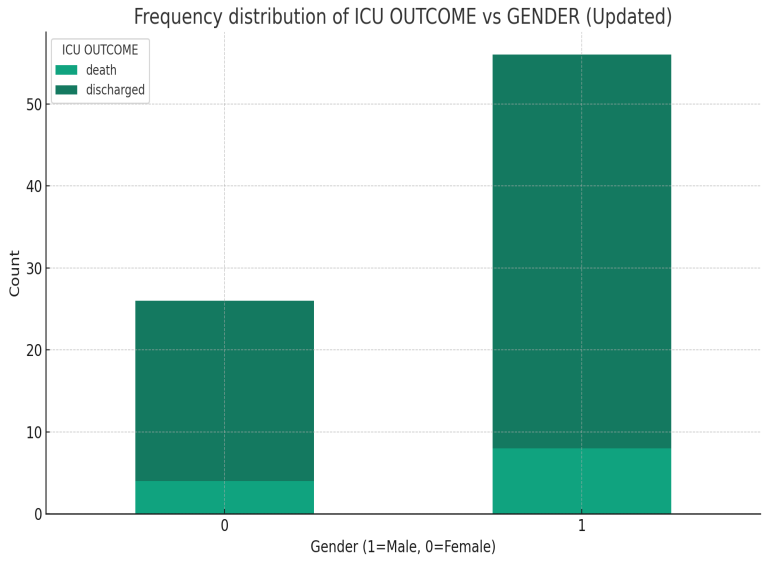


Fig. 22: Bar chart of ICU outcome vs gender

BMI- ICU outcome

The death group has a higher average and median BMI compared to the discharge group. The spread of BMI values (indicated by the interquartile range) is similar for both outcomes, but the death group exhibits more variability in the higher range. The discharge group has a more consistent and concentrated distribution around the median compared to the death group. (Fig. 23)

The Pearson's correlation coefficient between BMI and ICU death is −0.2358 and the p-value is 0.0330 ($p<0.05$).

The Pearson's correlation coefficient was −0.2358 suggesting a weak negative correlation between BMI and the ICU outcome as death indicating that as the BMI increases, there is a slightly higher likelihood of the outcome being death rather than discharge. However, the relationship is weak.

Descriptive Statistics for BMI/IBW based on ICU OUTCOME

	death	discharge
count	12.0	70.0
mean	27.791666666666668	24.735714285714288
std	6.4799632902065305	4.105564824220892
min	20.2	16.0
25%	23.5	21.924999999999997
50%	26.75	24.0
75%	29.725	27.5
max	45.0	36.0

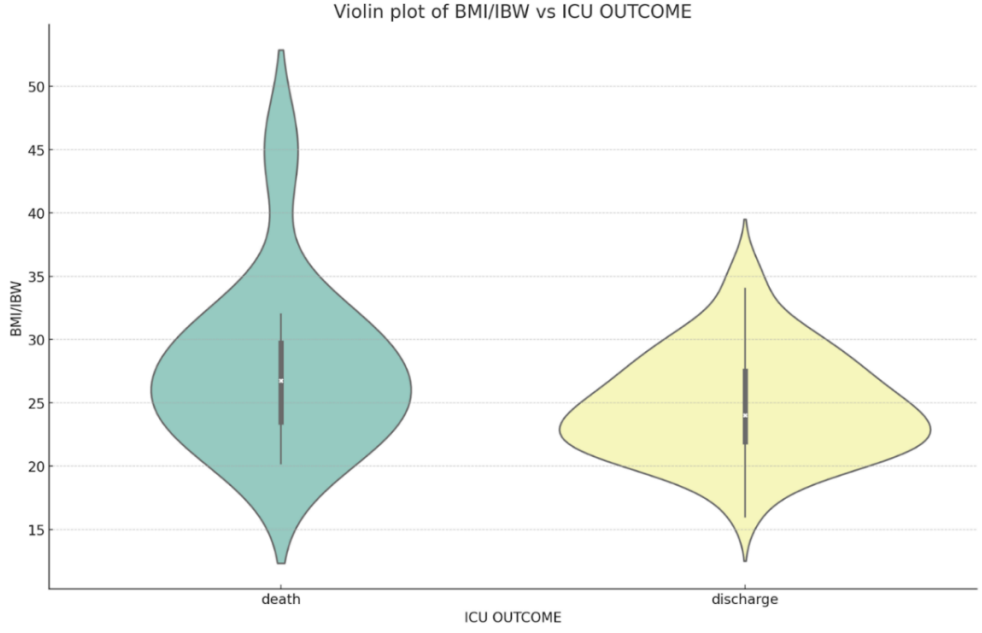


Fig.23: Violin plot of BMI vs ICU outcome.

Impact of Comorbidities on ICU Outcomes

This analysis aims to assess the relationship between metabolic and respiratory comorbidities and ICU outcomes. The data was segmented based on the recorded comorbidities. Each segment was then analysed against ICU outcomes, i.e., death or discharge. Statistical significance was gauged using p-values, setting a threshold of 0.05 for significance.

Results

Metabolic Comorbidities:

Obesity: Among the subjects without obesity there were 6 deaths and 51 discharges, compared to 6 deaths and 19 discharges in subjects with obesity. The p-value of 0.211 suggests no significant association.

Systemic Hypertension (SHTN): Among subjects without SHTN there were 11 deaths and 48 discharges, whereas in subjects with SHTN, there was 1 death and 22 discharges. The p-value of 0.194 indicates no significant association.

Diabetes Mellitus (DM): Among subjects without DM there were 11 deaths and 62 discharges, while in those with DM, there was 1 death and 8 discharges. A p-value of 1.0 points to no association.

Respiratory comorbidities :

Out of the 12 subjects with Tuberculosis, 2 subjects succumbed while 10 were discharged. The p-value was 1.0, indicating no statistically significant association.

There were 2 deaths and 25 discharges among the 27 COPD patients. A p-value of 0.335, was obtained revealing no significant correlation to ICU outcomes.

Among asthma patients (4 subjects), there were 3 discharges and no deaths, with a p-value of 1.0, emphasizing no significant statistical association.

Patients with cancer experienced an even split, with 3 deaths and 3 discharges. The p-value of 0.052 suggests no strong correlation with ICU outcomes.

Out of a total of 4 subjects with Pulmonary embolism (PE) there was 1 death and 3 discharges. The associated p-value of 1.0 demonstrates no significant association.

Association of Diagnoses with ICU Outcomes:

This analysis evaluates the association between diagnoses and ICU outcomes. Each diagnosis is analysed against ICU outcomes (death or discharge) to compute its significance as presented in table 23.

Analysis :

Below are the computed p-values for each diagnosis in relation to ICU outcomes:

Table 22: P values for each diagnosis in relation to ICU outcomes

Diagnosis	P-Value
cardiogenic shock	0.67292
septic shock	0.000002
ARDS	0.81797
poisoning	0.0522
AECOPD	0.43374
asthma	0.82439
IPA	0.90904
ABPA	0.74577
Bronchiectasis	0.54344
TB	0.3568
PE	0.90904
pulmonary edema	0.90904
CTEPH	0.0522
ILD	0.00925
ca lung	0.00264
pneumonia	0.87268
OSA	0.78242
Pneumothorax	0.6392

The bar chart below displays the p-values for each diagnosis in relation to ICU outcomes: Fig.24.

Interpretation

Septic Shock (P-Value: 0.000002), ILD (P-Value: 0.00925), and Ca Lung (P-Value: 0.00264) are the diagnoses that have shown a significant association with ICU outcomes.

For diagnoses like Cardiogenic Shock (P-Value: 0.6729), ARDS (P-Value: 0.8179), Poisoning (P-Value: 0.0522), and others diagnoses have p-values above 0.05. These diagnoses do not exhibit a statistically significant association with ICU outcomes.

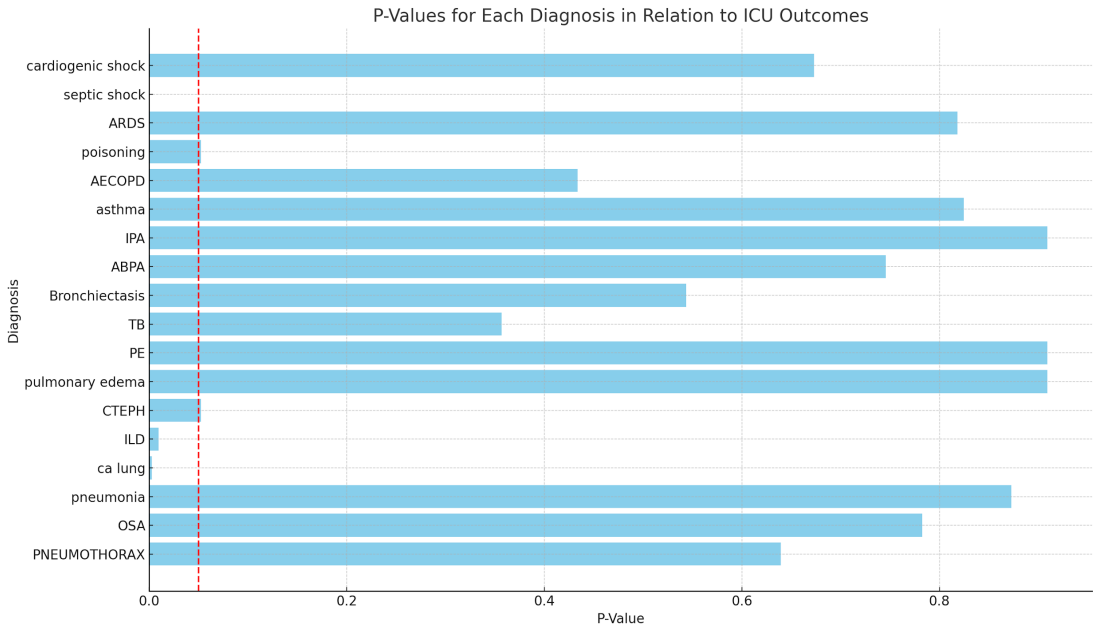


Fig 24: The p-values for each diagnosis in relation to ICU outcomes

APACHE II influencing ICU outcomes

The APACHE II score is a well-established tool used in ICUs to predict the severity of a patient's illness and the likelihood of their outcome. From the patients studied: Patients with scores in the range of 16-20 and 21-25 dominate the study. A significant portion of patients across all score ranges were discharged, but a noteworthy number of patients with scores between 16-25 negative ICU Outcome(death). (Fig. 25)

The p-value of 0.113 for Chi-square analysis indicates that, at a significance level of 0.05, there isn't a statistically significant association between APACHE II scores and ICU outcomes.

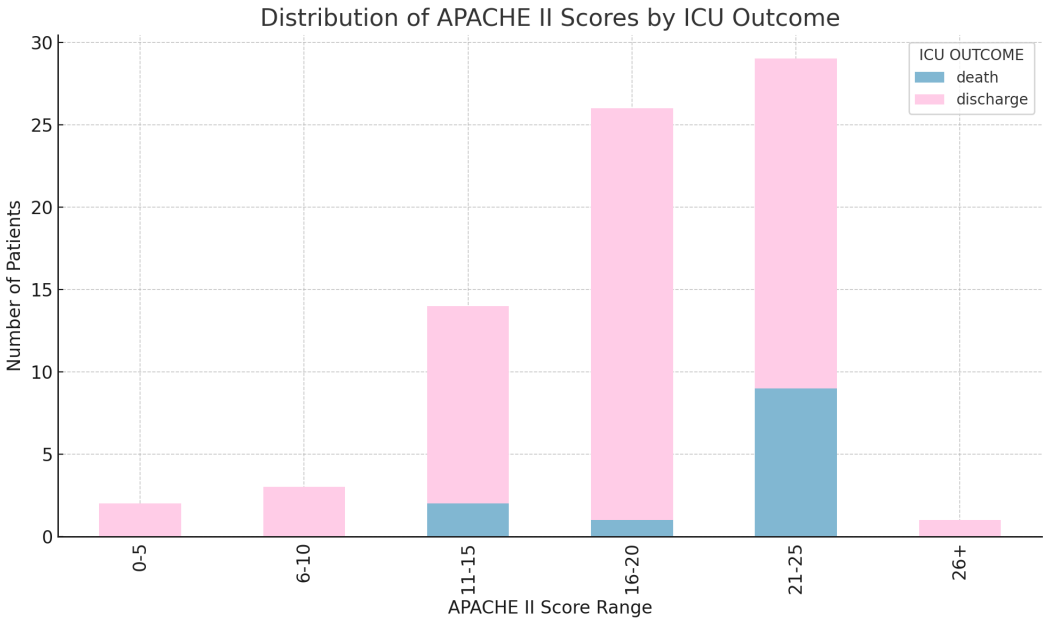


Fig.25: Distribution of APACHE II by ICU outcome

Impact of drugs on ICU outcomes:

From the plots and tables, the following insights are drawn (Fig. 26):

- STEROID DAYS: Patients who received steroids for 0-2 days had a higher percentage of death (75%) than those who received steroids for a longer duration. A significant majority (87%) of patients treated for 3-6 days were discharged.
- SEDATION DAYS: A higher percentage (69%) of patients who were sedated for 3-6 days had a fatal outcome compared to those sedated for shorter durations.
- NMB DAYS: There's a high death rate (71%) for patients who received NMB for 3-6 days.
- VASOPRESSOR DAYS: The outcome seems fairly balanced for patients treated for 0-2 days, with a 50-50 split between death and discharge. However, the longer the vasopressor treatment duration, the higher the discharge rate, reaching 100% for treatments of 7 days or more.

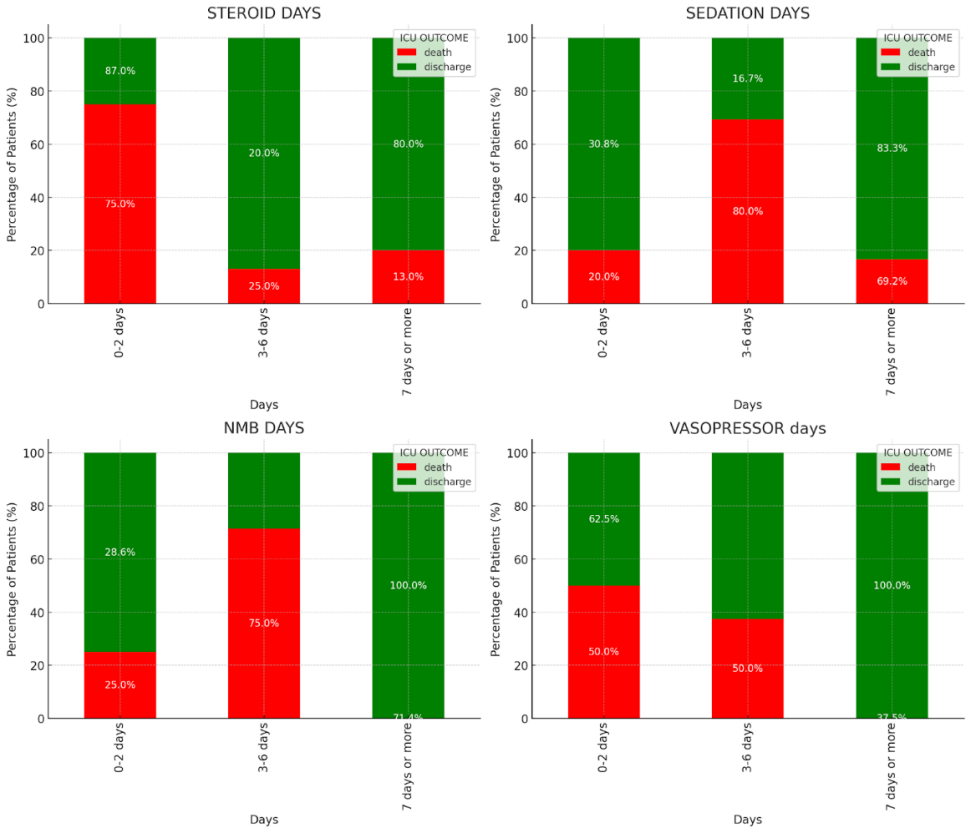


Fig.26: ICU outcome based on drugs

SBT Variables correlation with Outcome

The Pearson correlation coefficients were calculated between various test scores SBT-DT, SBT-BMRC, SBT-Handgrip, SBT-Quadriceps strength and ICU-related outcomes.

The heatmap as shown in Fig 27 visually depict the associations between the SBT measures and ICU outcomes. The Pearson correlation coefficient on each plot provides a numeric measure of the strength and direction of these relationships.

Heatmap and Explanation

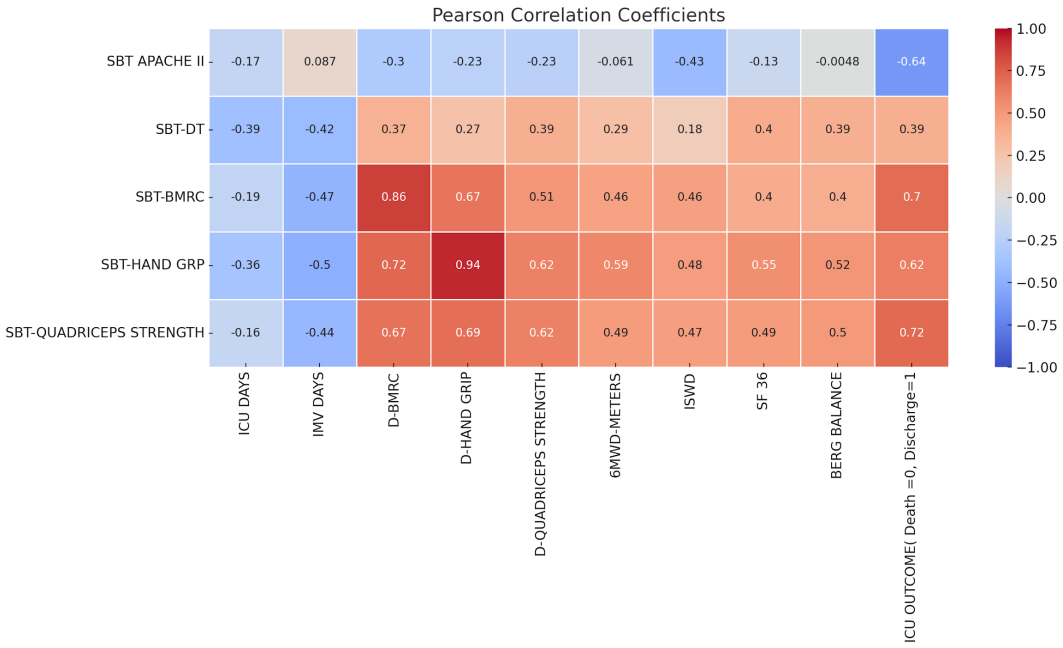


Fig 27: Heatmap of the associations between the SBT measures and ICU outcomes

The heatmap visually provides the Pearson correlation coefficients between various test scores and ICU-related outcomes. The color gradient is designed to emphasize the strength and direction of the correlations:

1. Dark Blue: Represents strong positive correlations.

2. Dark Red: Denotes strong negative correlations.

3. Lighter Shades (Closer to White): Indicate weak or no correlation.

Interpretation

The scatter plots combined with the Pearson correlation coefficients present a multifaceted view of the relationships between the test scores and ICU outcomes.

1. Nature of Correlation: The Pearson correlation coefficient quantifies the strength and direction of the linear relationship between two variables. A value close to 1 or -1 signifies a strong correlation, whether positive or negative, respectively. Values near 0 denote weak or no linear correlation.
2. SBT APACHE II Score's clinical implications: The scatter plots and coefficients indicate that the SBT APACHE II score possesses a significant negative correlation with several outcomes, notably ICU outcome. This suggests that as the score rises, there is an increased risk of unfavourable ICU outcomes.
3. Relevance of other scores: The SBT-Diaphragm Thickness, SBT-BMRC, SBT-Handgrip, and SBT-Quadriceps strength predominantly exhibit positive correlations with ICU discharge outcomes. This could be interpreted to mean that higher scores in these tests might be indicative of better patient outcomes and improved physical capability.

Factors influencing ICU, hospital outcomes

Among all the 82 study participants, the factors influencing ICU discharge were analysed to look for the possible predictive factors

ICU days:

Table 23: Table Factors influencing ICU days

Variable	Correlation Coefficient	p-value
Sedation received	0.30	0.005379
NMB received	0.47	<0.05
Vasopressors received	0.29	0.006
Steroid days	0.25	0.023217
Sedation days	0.699	<0.05
NMB days	0.569	<0.05
Vasopressor days	0.43518	<0.05
SBT-hand grip	-0.35	0.001

Interpolation

In the context of Pearson's correlation, positive correlations were observed in patients who received sedation (r=0.30, p=0.0054), neuromuscular blockers (r=0.47, p<0.05), and vasopressors (r=0.29, p=0.006) signify that increases in these variables are linearly associated with longer ICU stays.

Moreover, the strong positive correlations between sedation days (r=0.699, p<0.05) and NMB DAYS (r=0.569, p=0.05) with ICU days illustrate that prolonged use of sedation and neuromuscular blockers is linearly related to extended ICU stays.

Lastly, the negative correlation with SBT-hand grip (r=−0.35, p=0.001) implies that improved hand grip strength is linearly related to reduced ICU days, indicating better strength.

IMV days:

Table 24: Factors influencing IMV days

Variable	Correlation Coefficient	p-value
APACHE II	0.33	0.003001
Steroids received	0.22	0.045138
Sedation received	0.66	<0.05
NMB received	0.74	<0.05
Vasopressors received	0.57	<0.05
Sedation days	0.90	<0.05
NMB days	0.78	<0.05
Vasopressor days	0.56	<0.05
Mean fentanyl dose mcg/IMV days	0.42	<0.05
Mean midazolam dose mg/IMV days	0.41	0.0001
Mean NMB dose mg/IMV days	0.36	0.0007
SBT-Diaphragm thickness	-0.42	0.035
SBT-BMRC	-0.47	<0.05
SBT-hand grip	-0.50	<0.05
SBT-quadriceps strength	-0.44	<0.05

Interpretation:

In analysing the linear relationships between IMV (Invasive Mechanical Ventilation) days and clinical parameters and interventions, significant correlations are observed

The variable APACHE II shows a positive Pearson's correlation with IMV days ($r=0.33$, $p=0.003$), suggesting that higher APACHE II scores, indicative of more severe disease, are associated with prolonged need of invasive mechanical ventilation.

The positive correlation between receipt of steroids ($r=0.22$, $p=0.045$), sedation ($r=0.66$, $p<0.05$), NMB ($r=0.74$, $p<0.05$), and vasopressors ($r=0.57$, $p<0.05$) with IMV days implies that patients who receive these interventions tend to have prolonged durations of IMV.

Particularly noteworthy is the positive correlation between the sedation days and IMV days ($r=0.901$, $p<0.05$), suggesting a strong linear relationship between the duration of sedation and the duration of invasive mechanical ventilation. Similarly, strong positive correlations are observed with NMB days ($r=0.790$, $p<0.05$) and vasopressor days ($r=0.563$, $p<0.05$),

Negative correlations with SBT-Diaphragm thickness ($r=-0.421$, $p=0.03$), SBT-BMRC ($r=-0.471$, $p<0.05$), SBT-hand grip ($r=-0.50$, $p<0.05$), and SBT-quadriceps strength ($r=-0.44$, $p<0.05$) indicate that improvements in these parameters are associated with reduced IMV days

Discharge-BMRC:

Table 25: Factors influencing Discharge-BMRC

Variable	Correlation Coefficient	p-value
Smoking status	-0.29	0.014
Smoking index	-0.26	0.027
APACHE II	-0.41	0.0004
Steroids received	-0.27	0.02
Sedation received	-0.73	<0.05
NMB received	-0.62	<0.05
Vasopressors received	-0.69	<0.05
Sedation days	-0.57	<0.05
NMB days	-0.64	<0.05
Vasopressor days	-0.56	<0.05
Mean steroid dose mg/IMV days	-0.31	0.007983
Mean fentanyl dose mcg/ IMV days	-0.55	<0.05
Mean midazolam dose mg/ IMV days	-0.55	<0.05
Mean NMB dose mg/ IMV day	-0.64	<0.05
Mean noradrenaline mcg/ IMV days	-0.46	<0.05
SBT-BMRC	0.86	<0.05

SBT-hand grip	0.72	<0.05
SBT-quadriceps strength	0.67	<0.05

Interpretation:

The analysis of Discharge-BMRC reveals several significant correlations, providing insights into the relationships between different variables in clinical settings.

A negative correlation is observed between Discharge-BMRC and smoking status ($r=-0.29$, $p=0.014$) smoking index negatively correlated ($r=-0.26$, $p=0.02$), reinforcing the potential adverse effects of smoking on muscle strength.

The negative correlation between APACHE II and Discharge-BMRC ($r=-0.41$, $p=0.0004$) suggests that higher APACHE II scores, indicative of more severe disease, are associated with lower respiratory muscle strength

Negative correlations with steroids received ($r=-0.27$, $p=0.02$), sedation received ($r=-0.73$, $p<0.05$), NMB received ($r=-0.62$, $p<0.05$), and vasopressors received ($r=-0.69$, $p=1.76\times10-11$) with Discharge-BMRC imply that receiving these interventions may be associated with lower muscle strength. Moreover, the negative correlations between sedation days ($r=-0.57$, $p<0.05$), NMB DAYS ($r=-0.64$, $p<0.05$), and vasopressor days ($r=-0.56$, $p<0.05$) with Discharge-BMRC illustrate the significant impact of the duration of these interventions on muscle strength.

Positive correlations with SBT-BMRC ($r=0.86$, $p<0.05$), SBT-handgrip ($r=0.72$, $p<0.05$), and SBT-quadriceps strength ($r=0.67$, $p<0.05$) suggest that improvements in these variables are associated with better Discharge-BMRC scores

Discharge-Hand Grip:

Table 26: Factors influencing Discharge-Hand Grip

Variable	Correlation Coefficient	p-value
APACHE II	-0.27	0.02
Sedation received	-0.47	<0.05
NMB received	-0.40	0.0005
Vasopressors received	-0.51	<0.05
Sedation days	-0.36	0.001
NMB days	-0.43	0.0001
Vasopressor days	-0.43	0.0002
Mean fentanyl dose mcg/IMV days	-0.34	0.003
Mean midazolam dose mg/IMV days	-0.35	0.003
Mean NMB dose mg/IMV days	-0.44	0.0001
Mean noradrenaline mcg/IMV days	-0.37	0.001
SBT-BMRC	0.67	<0.05
SBT-hand grip	0.94	<0.05
SBT-quadriceps strength	0.69	<0.05

Interpretation:

The negative correlation between APACHE II and Discharge-Hand Grip ($r=-0.27$, $p=0.02$) suggests that patients with higher severity of illness, as indicated by the APACHE II scores, tend to exhibit lower Discharge-Hand Grip values, emphasizing the impact of disease severity on muscle strength.

Significant negative correlations are identified with receipt of sedation ($r=-0.47$, $p=0.00003$), NMB ($r=-0.40$, $p=0.0005$), and vasopressors ($r=-0.51$, $p<0.05$), highlighting the potential adverse effects of these drugs on muscle strength

Similarly, the duration of interventions, represented by sedation days ($r=-0.36$, $p=0.001$), NMB days ($r=-0.440$, $p=0.0001$), and vasopressor days ($r=-0.423$, $p=0.0003$), also show strong negative correlations with Discharge-Hand Grip.

Discharge-Quadriceps Strength:

Table 27: Factors influencing Quadriceps Strength

Variable	Correlation Coefficient	p-value
APACHE II	-0.32	0.006
Sedation received	-0.40	0.0005
NMB received	-0.33	0.004
Vasopressors received	-0.55	<0.05
Sedation days	-0.38	0.0008
NMB days	-0.41	0.0004
Vasopressor days	-0.39	0.0006
Mean fentanyl dose mcg/IMV days	-0.34	0.003
Mean midazolam dose mg/IMV days	-0.35	0.003
Mean NMB dose mg/IMV day	-0.36	0.001
Mean noradrenaline mcg/IMV days	-0.46	<0.05
SBT-BMRC	0.51	<0.05
SBT-hand grip	0.61	<0.05
SBT-quadriceps strength	0.61	<0.05

Interpretation:

A moderate negative correlation with APACHE II ($r=-0.32$, $p=0.006$)

The significant negative correlations observed with receipt of sedation ($r=-0.40$, $p=0.0005$), NMB ($r=-0.34$, $p=0.004$), and vasopressors ($r=-0.555$, $p<0.05$)

Similarly, the duration of these interventions, represented by sedation days ($r=-0.388$, $p=0.0008$), NMB days ($r=-0.408$, $p=0.0004$), and vasopressor days ($r=-0.396$, $p=0.0006$), also exhibit moderate negative correlations.

The positive correlations observed with SBT-BMRC ($r=0.513$, $p<0.05$), SBT-handgrip ($r=0.616$, $p<0.05$), and SBT-quadriceps strength ($r=0.617$, $p<0.05$) imply that improvements in these variables are associated with enhanced clinical parameters, stressing the importance of maintaining and improving muscular functions for better clinical outcomes.

6 Minute Walk Distance (6MWD):

Table 28: Factors influencing 6MWD

Variable	Correlation Coefficient	p-value
APACHE II	-0.307536554	0.010737
IMV/NIV	0.246912195	0.040823
Steroids received	-0.46341408	6.07E-05
Sedation received	-0.496798455	1.41E-05
NMB received	-0.441950778	0.000144
Vasopressors received	-0.459110268	7.25E-05
Steroid days	-0.404920004	0.000558
Sedation days	-0.298791662	0.012636
NMB days	-0.388415353	0.000974
Vasopressor days	-0.397439878	0.000721
Mean steroid dose mg/ IMV days	-0.33836213	0.004459
Mean fentanyl dose mcg/ IMV days	-0.452758713	9.38E-05
Mean midazolam dose mg/ IMV days	-0.454715799	8.67E-05
Mean NMB dose mg/ IMV day	-0.315585599	0.008256
Mean noradrenaline mcg/ IMV days	-0.356495777	0.002642
SBT-BMRC	0.459948102	7.01E-05
SBT-hand grip	0.585415762	1.27E-07
SBT-quadriceps strength	0.488278342	2.08E-05

Interpretation

APACHE II's moderate negative correlation with 6MWD (r=−0.3075, p=1.07 x 10^-2) underscores the interaction between the severity of illness and physical endurance. This suggests that patients with a higher APACHE II score, indicative of more severe illness, might have reduced walking distances.

IMV/NIV, with its positive correlation (r=0.2469, p=4.08 x 10^-2), hints at an association between the mode of respiratory support and 6MWD. This could suggest that the type or efficiency of respiratory support may influence physical endurance.

The significant negative correlations observed with receipt of steroids (r=−0.4634, p=6.07 x 10^-5), sedation (r=−0.4968, p=1.41 x 10^-5), and vasopressors (r=−0.4591, p=7.25 x 10^-5).

The durations of these interventions, represented by steroid days (r=−0.4049, p=5.58 x 10^-4), sedation days (r=−0.2988, p=1.26 x 10^-2), and vasopressor days (r=−0.3974, p=7.21 x 10^-4), also display significant negative correlations.

The positive correlations with SBT-BMRC (r=0.4599, p=7.01 x 10^-5), SBT-hand grip (r=0.5854, p=1.27 x 10^-7), and SBT-quadriceps strength (r=0.4883, p=2.08 x 10^-5) indicate that enhancements in these parameters are associated with increased 6MWD. This emphasizes the importance of muscular functionality and early exercise training in determining patient mobility.

The study's findings signify the relationship between clinical parameters and the 6 Minute Walk Distance (6MWD). The severity of illness, as denoted by the APACHE II score, directly impacts physical endurance. Clinical interventions, particularly the duration of steroids, sedation, and vasopressors significantly affect the 6MWD. Additionally, muscular functionality emerges as a crucial determinant of patient mobility and physical endurance.

Incremental Shuttle Walk Distance (ISWD):

Table 29: Factors influencing ISWD

Variable	Correlation Coefficient	p-value
Age	-0.3227387	0.006837
APACHE II	-0.354037824	0.003057
IMV/NIV	0.314813346	0.008423
Steroids received	-0.463519197	6.05E-05
Sedation received	-0.487652393	2.14E-05
NMB received	-0.381637098	0.001214
Vasopressors received	-0.480388352	2.95E-05
Steroid days	-0.420212316	0.000325
Sedation days	-0.334845028	0.004919
NMB days	-0.377806791	0.001372
Vasopressor days	-0.388314639	0.000977
Mean steroid dose mg/ IMV days	-0.311616552	0.009149
Mean fentanyl dose mcg/ IMV days	-0.412678412	0.000425
Mean midazolam dose mg/ IMV days	-0.413887788	0.000408
Mean NMB dose mg/ IMV day	-0.301330508	0.011866
Mean noradrenaline mcg/ IMV days	-0.341493743	0.004083
SBT-BMRC	0.463371828	6.08E-05
SBT-hand grip	0.477831282	3.3E-05
SBT-quadriceps strength	0.468836314	4.84E-05

Interpretation:

The correlation analysis between various clinical parameters and the ISWD provides significant relationships, Age shows a moderate negative correlation with ISWD (r=−0.3227, p=6.84 x 10^-3), implying that as age increases, the walking distance in the incremental shuttle test tends to decrease. This highlights the natural decline in physical endurance associated with aging.

APACHE II exhibits a moderate negative correlation with ISWD (r=−0.3540, p=3.06 x 10^-3), signifying that patients with a higher severity of illness might have reduced walking distances, accentuating the influence of health condition on endurance.

The significant negative correlations observed with receipt of steroids (r=−0.4635, p=6.05 x 10^-5), sedation (r=−0.4877, p=2.14 x 10^-5), and vasopressors (r=−0.4804, p=2.95 x 10^-5) signify the potential impacts of these interventions on ISWD. These findings underline the judicious use of these treatments, considering their potential to hinder patient mobility.

The duration of these interventions, represented by steroid days (r=−0.4202, p=3.25 x 10^-4), sedation days (r=−0.3348, p=4.92 x 10^-3), and vasopressor days (r=−0.3883, p=9.77 x 10^-4), also exhibit significant negative correlations with ISWD. This accentuates the influence of treatment duration on physical endurance and underscores the need for optimal management.

The positive correlations with SBT-BMRC (r=0.4634, p=6.08 x 10^-5), SBT-hand grip (r=0.4778, p=3.3 x 10^-5), and SBT-quadriceps strength (r=0.4688, p=4.84 x 10^-5) indicate that enhancements in these parameters can positively impact ISWD.

Conclusion

The analysis delineates significant negative correlations between several clinical interventions, their durations, and age with ISWD.

Moreover, the strong positive correlations observed with parameters related to muscle functionality emphasize the critical role of muscular health and rehabilitation in achieving optimal ISWD results.

SF 36 health survey:

Table 30: Factors influencing SF 36 health survey

Variable	Correlation Coefficient	p-value
APACHE II	-0.325552979	0.006748
IMV/NIV	0.26399869	0.028385
Steroids received	-0.30499777	0.010827
Sedation received	-0.411157687	0.000449
NMB received	-0.400603527	0.000647
Vasopressors received	-0.429424581	0.000231
Steroid days	-0.266812531	0.02668
Sedation days	-0.307374813	0.010196
NMB days	-0.329460436	0.005704
Vasopressor days	-0.306612764	0.010394
Mean fentanyl dose mcg/ IMV days	-0.408487937	0.000493
Mean midazolam dose mg/ IMV days	-0.407694209	0.000507
Mean noradrenaline mcg/ IMV days	-0.629046815	7.1E-09
SBT-BMRC	0.403940469	0.000577
SBT-hand grip	0.549794463	9.93E-07
SBT-quadriceps strength	0.488771783	2.03E-05

Interpretation

The exploration of the correlation between various clinical parameters and the SF 36 score, a measure of health-related quality of life, reveals several significant relationships that bear important clinical and therapeutic implications.

APACHE II's moderate negative correlation with SF 36 (r=−0.3256, p=6.75 x 10^-3) underscores the relationship between the severity of illness and patient-reported health status. Patients with higher APACHE II scores, indicative of more severe illness, might report lower quality of life.

IMV/NIV, with its positive correlation (r=0.2640, p=2.84 x 10^-2), signifies an

association between the mode of respiratory support and the SF 36 score. Mode of ventilation showcases a moderate positive correlation with SF 36 (r=0.4100, p=2.30 x 10^-3), underscoring the potential influence of therapeutic interventions on patient-reported outcomes.

Significant negative correlations with receipt of sedation (r=−0.4112, p=4.49 x 10^-4), NMB (r=−0.4006, p=6.47 x 10^-4), and vasopressors (r=−0.4294, p=2.31 x 10^-4) reflect the potential influence of these interventions on patient-reported health status. This underlines the importance of judicious administration to ensure the best possible quality of life.

The durations of the interventions, represented by steroid days (r=−0.2668, p=2.67 x 10^-2), sedation days (r=−0.3074, p=1.02 x 10^-2), and NMB days (r=−0.3295, p=5.70 x 10^-3), also display significant negative correlations with SF 36. This accentuates the importance of monitoring and optimizing the duration of these interventions for improved patient outcomes.

The positive correlations observed with SBT-BMRC (r=0.4039, p=5.77 x 10^-4), SBT-hand grip (r=0.5498, p=9.93 x 10^-7), and SBT-quadriceps strength (r=0.4888, p=2.03 x 10^-5) suggest that enhancements in these parameters are associated with higher SF 36 scores. This emphasizes the importance of maintaining and improving muscular functions for a better quality of life.

Conclusion:

The analysis delineates significant correlations between clinical interventions and their durations with the SF 36 scores.

Berg Balance Scale:

Table 31: Factors influencing Berg Balance Scale

Variable	Correlation Coefficient	p-value
APACHE II	-0.322430646	0.007328
Admission-Diaphragm Thickness	0.345192229	0.003674
IMV/NIV	0.315627379	0.008247
Steroids received	-0.264374798	0.028152
Sedation received	-0.358557992	0.002484
NMB received	-0.36235746	0.002216
Vasopressors received	-0.359212852	0.002436
NMB days	-0.285527835	0.017398
Vasopressor days	-0.257123552	0.03294
Mean fentanyl dose mcg/ IMV days	-0.279292897	0.020123
Mean midazolam dose mg/ IMV days	-0.279663816	0.019951
Mean noradrenaline mcg/ IMV days	-0.485774903	2.33E-05
SBT-BMRC	0.396016754	0.000756
SBT-hand grip	0.520559499	4.54E-06
SBT-quadriceps strength	0.496601084	1.43E-05

Interpretation

Correlation analysis between clinical parameters and the Berg Balance Score (a measure of balance and risk of falls) reveals:

APACHE II's negative correlation with Berg Balance (r=−0.3224, p=7.33 x 10^-3) indicates that a higher severity of illness may associate with reduced balance scores.

Admission-Diaphragm Thickness shows a positive correlation with Berg Balance (r=0.3452, p=3.67 x 10^-3), suggesting a potential relationship between the admission date and balance scores.

IMV/NIV's positive correlation with Berg Balance (r=0.3156, p=8.25 x 10^-3) hints at

a link between the mode of respiratory support and balance.

Interventions like steroids received (r=−0.2644, p=2.82 x 10^-2), sedation received (r=−0.3586, p=2.48 x 10^-3), and vasopressors received (r=−0.3592, p=2.44 x 10^-3) show negative correlations with Berg Balance.

The duration and doses of interventions, represented by NMB days (r=−0.2855, p=1.74 x 10^-2), vasopressor days (r=−0.2571, p=3.29 x 10^-2), and mean fentanyl dose mcg/IMV days (r=−0.2793, p=2.01 x 10^-2), also display negative correlations with Berg Balance.

Parameters like SBT-BMRC (r=0.3960, p=7.56 x 10^-4), SBT-hand grip (r=0.5206, p=4.54 x 10^-6), and SBT-quadriceps strength (r=0.4966, p=1.43 x 10^-5) show positive correlations with Berg Balance.

Conclusion

The analysis reveals that the severity of illness, as indicated by APACHE II, correlates negatively with the Berg Balance Score, implying that sicker patients may have reduced Berg balance scores. Conversely, parameters like admission-Diaphragm thickness and IMV/NIV correlate positively with Berg Balance, suggesting potential factors that might improve balance. However, clinical interventions such as receipt of steroids, sedation, and vasopressors, along with their durations and doses, correlate negatively with Berg Balance. Muscle functionality parameters, including SBT-BMRC, SBT-hand grip, and SBT-quadriceps strength, show positive correlations, highlighting their role in determining balance scores.

ICU outcome as discharge:

Table 32: Factors influencing ICU outcome as discharge

Variable	Correlation Coefficient	p-value
APACHE II	-0.282736149	0.010543
Vasopressors received	-0.258827007	0.018877
Vasopressor days	-0.250289727	0.023335
Mean NMB dose mg/ IMV day	-0.220208176	0.046819
Mean noradrenaline mcg/ IMV days	-0.310346789	0.004546
Mean noradrenaline mcg/ICU days	-0.370784792	0.000605
SBT APACHE II	-0.496645934	0.009855
SBT-Diaphragm thickness	0.479755984	0.015228
SBT-BMRC	0.34087651	0.001974
SBT-hand grip	0.353454622	0.001299
SBT-quadriceps strength	0.342990986	0.001842

Interpretation

The correlation analysis between clinical parameters and the ICU outcome, considering discharge, reveals the following:

APACHE II exhibits a negative correlation with ICU discharge ($r=-0.2827$, $p<0.5$). A higher APACHE II score, indicating a more severe illness, might associate with a reduced probability of discharge.

Receipt of vasopressors ($r=-0.2588$, $p=1.89 \times 10^{-2}$) and the number of vasopressor days ($r=-0.2503$, $p<0.05$) both exhibit negative correlations with ICU discharge. Mean NMB dose mg/IMV day has a negative correlation with ICU discharge ($r=-0.2202$, $p<0.05$). Mean noradrenaline mcg/IMV days ($r=-0.3103$, $p=4.55 \times 10^{-3}$) displays negative correlations with ICU discharge.

SBT APACHE II has a negative correlation with ICU discharge (r=−0.4966, p=9.86 x 10^-3).

In contrast, SBT-DT (r=0.4798, p=1.52 x 10^-2), SBT-BMRC (r=0.3409, p=1.97 x 10^-3), SBT-hand grip (r=0.3535, p=1.30 x 10^-3), and SBT-quadriceps strength (r=0.3430, p=1.84 x 10^-3) all show positive correlations with ICU discharge.

Conclusion:

The analysis indicates that several clinical parameters are significantly correlated with ICU discharge outcomes. While many interventions, their durations, and severity markers correlate negatively with discharge, certain muscular and respiratory function tests show a positive correlation

Multivariate analysis of ICU outcome as death

Multivariate logistic regression was initially applied, but multicollinearity was observed among predictors. Logistic regression with L1 lasso regularization was employed to address multicollinearity and identify relevant predictors.

Regularized logistic regression identified the following predictors for ICU outcome as death:

- APACHE II: Coefficient of 0.001732
- MEAN NORADRENALINE MCG/IMV DAYS: Coefficient of 0.000111
- MEAN NORAD MCG/ICU DAYS: Coefficient of 0.000053
- SBT APACHE II: Coefficient of 0.001245
- SBT-BMRC: Coefficient of -0.010618

APACHE II: Each unit increase in this score indicates a risk of death, consistent with its use as a severity-of-disease classification system.

Mean noradrenaline doses (both IMV DAYS & ICU DAYS): Higher levels of noradrenaline, used to manage hypotension, indicate a patient's compromised hemodynamic status.

SBT APACHE II: A higher score in this metric is associated with a risk of death.

SBT-BMRC: An increase in this parameter correlates with a decreased likelihood of death, pointing to its role or its linkage with less severe disease presentations.

DISCUSSION

Our study focus was to describe the epidemiology, clinical profile, and the outcomes that predicted progression in critically ill patients. We aimed to investigate the outcomes and the factors responsible for them in respiratory critically ill patients in an ICU setting in Central India.

Demographics:

Our study included a higher proportion of male patients falling in the middle-age category, while the females were lower in number and fell in the younger age category. Out of the total 82 patients in our study, 56 (68%) were males. There was also no significant relationship established between gender and overall mortality and ICU outcome ($p = 0.33$). In a study by Epstein et al. conducted in 1999, no significant relationship was found between the gender of individuals and overall mortality rate. The authors concluded that males and females showed no difference in the mortality rate after being admitted to the ICU on mechanical ventilation. There was also no difference found in the overall length of stay. (8) The results of our study were contradictory to the results obtained by Kollef et al. who demonstrated that gender does play a role in determining the overall mortality. They concluded that women requiring mechanical ventilation have a higher risk of mortality as compared to men. (7)

Another demographic detail that we analyzed was the age and the average range of age of the patients admitted to the ICU on mechanical ventilation. In our study, the average age of the males was 58.54 years. Most of the male population fell in the middle-aged to elderly range (27 – 85 years). This represented a more heterogeneous population. The average age of the females in our study was 48.35 years, and majority fell in the

younger age group category. The female age group represented a more homogeneous population with regards to their age. Our study found that age had a significant impact on the ICU outcomes ($p = 0.022$). It is generally assumed that an advanced age is a risk factor for poor outcomes in the ICU. As against this common belief, our study demonstrated no such effect of age on the outcomes in the ICU in patients on mechanical ventilation.

Our findings were similar to the study by Tang et al. who conducted a study by dividing patients in two groups based on age as the cut off criteria. Their study demonstrated similar results to our, with no significant effect of age on the overall ICU and hospital mortality in elderly patients on mechanical ventilation. (58) A similar observation as noted in a study conducted in 1998 by Leong and Tai. This study divided the patients into 4 groups using age as the criteria for the division. They concluded that age played no significant role in determining the outcomes in patients of Asian origin admitted to the ICU. (59) Other studies proved results contradictory to the results of our study. Frezza et al. proved in their study that elderly patients had a longer length of stay in the ICU as compared to the patients in the younger cohort. (11) In another study with contradictory findings, Zilberberg et al. and Epstein et al. concluded that an age >65 years is an independent predictor of death. (8,60)

Body Mass Index (BMI)

Our study demonstrated that the majority of the participants had their BMI clustered around the average range (between 22 and 28). The average BMI in our study was found to be 25.1 kg/m^2. No significant relationship was established between the presence of obesity and overall ICU outcomes in our study ($p = 0.2$). Previous studies have found

contradictory effects of BMI on the outcomes of patients admitted to the ICU. Trembley et al. found that underweight patients are at a higher risk of mortality as compared to those who's BMI falls in the higher range of >25 kg/m^2. Even obese or severely overweight patients were not shown to be at a higher risk of mortality or longer length of stay as compared to those that fall in the average range. It was concluded that lower BMI is associated with a worse functional status and outcome. (61) Ray et al. also conducted a study to demonstrate any effect of BMI on the outcome. Contrary to the above results and interpretation, this study found that BMI had no effect on the outcomes in the patients in the ICU. They stated that even in the presence of physiological changes occurring in the obese population, underweight or obesity is not associated with an increase in mortality or morbidity in the ICU. (13) However, in a study by Martino et al., it was concluded that the 60-day mortality was significantly lower in patients that were in the extremely obese category as compared to those that were in the average range with regards to the BMI. (15)

Comorbidities-metabolic

Our study aimed to assess the comorbidities associated with patients admitted to the ICU on mechanical ventilation. Amongst the patients included in our study, obesity along with the presence of diabetes mellitus was found to be highly likely and a common occurrence. However, the diagnosis of DM in the patients in our study was not found to significantly affect the ICU outcomes ($p = 1.0$). In a study by Akinosoglou et al. studied non-ICU septic patients to determine the effect of DM on their outcomes. The study consisted of a total of 812 patients. They concluded that DM does not negatively affect the outcomes in septic patients that do not require the ICU. (62) Roncon et al. conducted a systematic analysis in 2020 to assess the effect of DM in

patients with COVID19 pneumonia admitted to the ICU. It was noted that patients with DM reported to be at a significantly higher risk of being admitted in the ICU. Along with this, these patients were also shown to have a significantly higher mortality risk. (63) Another study by Seiglie et al. showed results similar to the above study. Again, this study was conducted to analyze the outcomes in COVID19 pneumonia patients with DM. This study noted that a higher proportion of patients with DM were required to be admitted in the ICU as compare to the COVID19 patients without DM. It was also demonstrated that a higher proportion of patients with DM along with COVID19 pneumonia required mechanical ventilation and died as compared to those without DM. The authors also analyzed the effects of obesity in this group of patients. They concluded that obesity was associated with a significantly higher risk of ICU admission and mechanical ventilation. Obesity did not show any association with mortality risk. (64) Similar results were observed in Greece in a study conducted by Halvatsiotis et al. Again, they aimed to determine the association between DM and other chronic diseases with obesity with the outcomes of critically ill patients with COVID19. This was a retrospective observational study conducted in 2020. Their findings were similar to the study by Seiglie et al. (64) They derived at the conclusion that the presence of DM and obesity contribute to the severity of the disease in COVID19 patients being admitted to the ICU. (65)

Kalligeros et al. conducted a retrospective study with an aim to study the association of obesity and ICU outcomes and requirement of mechanical ventilation in patients admitted with COVID19. They showed that in such patients, the presence of obesity increases the risk of being admitted to the ICU. They stated that an aggressive treatment in case of COVID19 patients with obesity is absolutely warranted. (66)

Our study also found that the presence of DM with systemic hypertension (SHTN) is also common. This may even have a negative effect on the outcomes in the patients admitted to the ICU. Again, our study found no significant effect of SHTN on ICU outcomes ($p = 0.1$). A systematic review conducted by Barrera et al. analyzed the presence of hypertension (HTN) and DM and their effect on the outcomes in patients with COVID19. (67) Their analysis included a total of 65 studies. In these, the overall prevalence of DM and HTN was found to be 12%, which increased to 18% in those with severe COVID19. The systematic analysis proved that the overall mortality risk and ICU admission increased significantly in the presence of DM and HTN in COVID19 patients as compared to those without these comorbidities. (67)

Comorbidities-respiratory

Our study showed a significant presence of COPD along with TB. About 8% of the total patients in our study had both TB alongside COPD. The presence of these disease conditions may even worsen the overall outcomes in ICU patients. In a study conducted by Park et al. it was demonstrated that a history of TB negatively affects the severity in patients with COPD, leading to worse outcomes. (68) In a systematic review and meta-analysis by Fan et al., similar findings were demonstrated. The analysis included 23 articles. The analysis concluded that those individuals with a prior history of TB have an increased risk of developing COPD. Also, these patients have a higher prevalence of COPD. (69) Yakar et al. carried out a prospective study to determine how the development of TB in an individual affects the natural course of COPD. This study was conducted in 2017, which included all patients admitted with COPD exacerbations. They were further categorized into patients with a previous history of TB and those without a history of TB in the past. Out of the total patients, 93 (15%) had TB. The

authors found that these patients developed COPD 4 years earlier than those without a previous history of TB, and died 5 years earlier. Also, in the group with past TB, the rate of hospitalizations in the year was found to be higher than the group without a past history of TB. They also found that a history of TB reduced pulmonary function. Thus, it was concluded that a past history of TB negatively affects the natural course of COPD. (70)

Our study demonstrated a substantial overlap of COPD with pulmonary hypertension (PHTN). This overlap was found in 29% of the total participants in our study. Owing to the overall frequency of COPD, it is known to be the most common cause of PHTN. The prognosis in patients with COPD that develop moderate-severe PHTN is relatively poor. Our study found a significant association between the presence of PHTN and ICU outcomes ($p = 0.03$).

Wrobel et al. carried out a single-center retrospective analysis of all lung transplant recipients over a period of 9 years for a primary diagnosis of COPD. A total of 46 patients were included in the final analysis being lung transplant recipients with COPD. They were further categorized into 3 groups: with mild, moderate and severe PHTN, with no difference in baseline demographics between the 3 groups. The study found that the presence of moderate to severe PHTN predicted the need for a longer duration of mechanical ventilation. The presence of moderate to severe PHTN also predicted a longer duration of stay in the ICU. However, there was no significant difference found in the 1-year survival between the 3 groups of patients. (71)

In our study, amongst all the patients with any respiratory comorbidity, PHTN accounted for the maximum fraction (49%). Along with a substantial overlap with

COPD as described, it also showed a significant overlap with Obstructive Sleep Apnea (OSA), which was found to be 16%. OSA also showed an overlap with COPD in 8% of the total patients. Patients with the overlap syndrome showing an overlap of OSA and COPD are known to be at a greater risk of developing PHTN as compared with patients who have either of these conditions alone. A study by Marin et al. was conducted to assess the relationship of this overlap syndrome to overall mortality as well as first-time hospitalization due to COPD exacerbations. They included patients belonging to 3 categories – those with overlap syndrome treated with CPAP, those with overlap syndrome not being treated with CPAP and those with COPD without OSA. Their study results found that the patients with overlap syndrome not being treated with CPAP showed a higher mortality risk as compared to those not being treated on CPAP. The results also concluded that the patients with overlap syndrome being treated with CPAP had a higher risk of being hospitalized with COPD exacerbations. The study overall concluded that patients with the overlap syndrome were more associated with an increased risk of death as well as hospitalization due to exacerbation of COPD. (72)

COPD overlap syndromes may include an overlap of COPD with OSA as described above or an overlap with other respiratory comorbidities like asthma and bronchiectasis. The term asthma-COPD overlap syndrome (ACOS) emerged to describe the condition with the overlap of both of these respiratory comorbidities in an individual patient. (73,74) A large prospective study was conducted that divided ACOS into two groups – early and late onset asthma groups. The study observed a significantly higher mortality rate in the late-onset asthma related ACOS group as compared to the early-onset group. (75) Our current study showed no overlap of COPD with asthma in the study population.

Diagnosis at the time of admission

We conducted an analysis of the different diagnosis present at the time of ICU admission. We found that about 40% of the patients presented with an acute exacerbation of COPD (AECOPD). The diagnosis of an AECOPD plays a significant role in determining the overall outcome of patients admitted in the ICU. AECOPD resulting in hospitalization may lead to severe adverse effects such as decline in pulmonary function, a decrease in the quality of life, re-exacerbations leading to re-hospitalization, cardiopulmonary complications and death. Thus, prevention of an AECOPD as well as prompt treatment of the same is necessary to prevent further complications and worse outcomes. A study was conducted by Brown et al. in 2022 to determine the factors that are independently associated with hospital mortality in those patients requiring an admission in the ICU due to exacerbation of COPD. The study was conducted over a 10-year period with a total of 305 patients included in the study. In this study, a total of 77% of the patients required non-invasive ventilation and 38.7% required invasive mechanical ventilation (IMV). The mean age of the patients was 67.4 years. It was concluded from this study that the age of the patient, requirement for IMV, and illness severity were the factors significantly associated with poor patient outcomes. (76)

Clinical Variables/Scoring Systems

APACHE II Score: The mean APACHE II score found in our study was 18.47. In our study the majority of patients, 35.4%, had an APACHE II score ranging from 16 to 20, followed closely by 37.8% with scores between 21 to 25. This distribution indicates that a significant proportion of the patients had moderate to high severity at admission. The p-value of 0.113 indicates that, at a significance level of 0.05, there isn't a

statistically significant association between APACHE II scores and ICU outcomes.

The APACHE II score assesses ICU patient severity. Although a significant number with scores 16-25 had negative outcomes, the p-value (0.113) suggests no significant association between scores and outcomes at a 0.05 level. However, a positive correlation (r=0.33, p=0.003) between APACHE II scores and IMV days indicates higher scores relate to longer mechanical ventilation. The difference in significance is likely due to the variables' distinct influences on ICU outcomes versus ventilation duration.

Various studies in the past have concluded that lower APACHE II scores correlate with better weaning outcomes. A study by Matic et al. concluded that an APACHE II score ≤ 20 had a favorable outcome with regards to weaning from mechanical ventilation as compared to those with an APACHE II score >20. Chen et al. derived at the conclusion that patients admitted to the ICU with an APACHE II score of <17 showed a lower risk of mortality as compared to those with a score >17. (29)

Drugs in the ICU

Steroids:

In this study 504.8% of the patients required steroids for a duration of 3 to 6 days. Additionally, 32.9% didn't require steroids at all. The necessity of steroids for extended periods of more than 7 days, was observed in 6.1% of the patients. We found a significant association between steroids and overall ICU outcomes in our study (p = 0.05). The RECOVERY trial had demonstrated that use of corticosteroids reduces the risk of mortality in mechanically ventilated patients diagnosed with ARDS in COVID19. (46) Similarly, the Codex trial was carried out in 2020. This trial was done

to determine the impact of the use of parenteral dexamethasone on the number of ventilator free days in ARDS patients with COVID19. The trial concluded that the use of steroids significantly increases the number of ventilator free days in ARDS patients with COVID19, especially in the initial 28 days of the disease. (34) However, studies have found results contradictory to the above. Ranzani et al. conducted a prospective study in 2012. The authors concluded that steroids must be used with extreme caution in critically ill patients as they carry a great risk of death in patients diagnosed with nosocomial pneumonia. (35)

Again, contrary to the findings of the above studies, Wieruszewski et al. conducted a retrospective study 2017 to determine the impact of corticosteroids in Pneumocystis carnii pneumonia. The study found no significant impact of steroids on the overall mortality in these patients. No impact was also found on the length of stay or need for mechanical ventilation in this group of patients. (36) These finding are contradictory to the findings above, where steroids have shown a significant impact on the overall mortality as well as need and duration of mechanical ventilation.

Neuromuscular blockers (NMBs) and Sedation

Neuromuscular blockers (NMBs): Our study found that NMBs were used in a great proportion of individuals included in our study. A total of 27.59% of patients required neuromuscular blocking agents for 1-2 days. A slightly lower percentage of 24.14% required them for 3-6 days, and a minority of 6.90% needed them for 7 days or more. NMBs are used in the ICU in order to facilitate the mechanical ventilation.

Sedation: A significant portion, approximately 41.38%, of patients required sedation for a duration spanning 3 to 6 days. The numbers for 1-2 days and for extended periods

of 7 days or more are relatively fewer, constituting 34.48% and 20.69% respectively. The p-value of 0.12 from the Chi-square test in our study suggests that the observed differences in outcomes based on sedation days might not be statistically significant at a 0.05 significance level. It is important to understand the outcomes of patients in whom these drugs have been used in the ICU and are on mechanical ventilation. Alejandro et al. conducted a prospective study to determine the use of sedatives and NMBs and their impact on the outcomes in patients on mechanical ventilation. The study found that a persistent use of sedatives was associated with a greater number of days on mechanical ventilation as compared with patients who were not on sedatives. The study also concluded that a persistent use of sedatives was significantly associated with more weaning days and a longer stay in the ICU. The use of NMBs was significantly associated with a longer duration of mechanical ventilation, higher mortality and longer stay in the ICU. (38)

Another trial that studied the impact of these drugs in the ICU was done by Papazian et al. Their aim was to evaluate the outcomes after two days of therapy with NMBs in patients in the ICU on mechanical ventilation. The trial concluded that in patients with ARDS, an early administration of NMBs improves the 90-day survival rate and also helps to increase the time off mechanical ventilation. (39)

Vasopressors

Another class of drugs that were used significantly in our current study were vasopressors. In our study, a striking 65.85% of patients did not require vasopressors. On the other hand, 12.2% needed vasopressors for 0-2 days. The need for intermediate (3 to 6 days) and long-term (>7 days) vasopressor support was observed in 19.5% and

2.4% of patients, respectively. The p-value of 0.94 suggests that, at a significance level of 0.05, there isn't a statistically significant association between the vasopressor days and the ICU outcome.

A randomized controlled trial by Lamontagne et al. conducted in 2020 included a total of 2600 patients. The study was done to determine the impact of reduced use of vasopressors on 90-day mortality in critically ill patients with vasodilatory hypotension. The trial finally concluded that in patients aged 65 years and above, reduction in the exposure to vasopressors did not significantly reduce the overall 90-day mortality. (77)

Factors influencing ICU, hospital outcomes:

1. Factors influencing duration of ICU days:

Sedation and ICU Stay: In our study it was identified that a strong positive correlation was observed between sedation days (r=0.699, p<0.05) with length of ICU days. This shows that prolonged use of sedation is linearly related to extended ICU stays. This is consistent with findings from Arroliga A et al. who also concluded that the use of sedatives is associated with a longer duration of mechanical ventilation, prolonged weaning, and stay in the ICU. (38) Similarly, as per Schweickert et al. prolonged immobility and deep sedation have been suggested to prolong ICU stay and sedation protocols needs to be designed to minimize the use of sedatives shown to decrease the duration of mechanical ventilation. (53)

Neuromuscular Blockers (NMB) and ICU stay: Our study found significant positive correlations between NMB days (r=0.569, p=0.05) with ICU durations. This illustrates that extended use of neuromuscular blockers leads to longer ICU stays. This aligns with Arroliga et al. findings, which showed that in 13% of patients, NMBs resulted in a

longer time on mechanical ventilation, extended ICU stays, and increased mortality. (38) While the use of NMBs is less documented than sedatives, preliminary studies from single institutions indicate rates ranging from 3.4% to 15.5%. Murray et al's retrospective review in a tertiary medical center found a 1.4% NMB usage in the ICU, primarily among patients with acute respiratory failure requiring mechanical ventilation (9%). (41)

2. Factors influencing duration of Invasive Mechanical Ventilation days (IMV days):

APACHE II-IMV days: In our study, a positive Pearson's correlation ($r=0.33$, $p=0.003$) was observed between APACHE II scores and IMV days, indicating that more severe disease is associated with a prolonged need for invasive mechanical ventilation. This was in accordance with the study conducted by Ravi Dosi et al. on the predictive ability of APACHE II to assess the duration of mechanical ventilation. APACHE II could successfully predict the duration of mechanical ventilation on day 3 of intubation. (78)

Steroids-IMV days: Our study reveals a significant positive correlation between the duration of IMV days and the administration of steroids ($r=0.22$, $p=0.045$), suggesting that patients have prolonged mechanical ventilation. A 2020 study by Villar et al. explored the impact of dexamethasone on patients with ARDS. Their focus was on the number of ventilator-free days within a 28-days. Their results underscored that early dexamethasone administration significantly reduced the need for mechanical ventilation and notably decreased overall mortality in those with moderate to severe ARDS ($p<0.0001$). (79)

Sedation & NMB-IMV days: Our study showed a strong positive correlation between IMV days and the duration of sedation ($r=0.901$, $p<0.05$), NMB ($r=0.790$, $p<0.05$) and vasopressor days ($r=0.563$, $p<0.05$). This observation is consistent with the study done

by Arroliga et al. on the influence of neuromuscular blockers and sedation in patients on mechanical ventilation. Longer duration of use of sedation and NMBs was associated with prolonged mechanical ventilation and weaning. (80)

Statistically significant negative relationships are evident between the duration of IMV days and SBT-Diaphragm thickness (r=−0.421), SBT-BMRC (r=−0.471), SBT-hand grip (r=−0.50), and SBT-quadriceps strength (r=−0.44). These findings suggest that enhancements in these measures lead to a decrease in IMV days.

Physical Limitations Post ICU discharge

Survivors of critical illness frequently experience enduring physical challenges, encompassing muscle weakness, diminished physical capacities, and a deterioration in their overall quality of life. Among the 70 patients who survived to ICU discharge, those with BMRC scores below 48 accounted for 5.71%, handgrip strength below 11 was observed in 1.43%, and quadriceps strength below 3 was found in 2.86%, all indicative of ICU-acquired weakness (ICUAW). Our objective was to study the ongoing trends in the occurrence of muscle weakness and physical limitations, as well as their association to critical illness and ICU-related outcomes.

3. Factors influencing discharge BMRC:

Drugs - discharge BMRC: The analysis of BMRC at the time of discharge showed an interconnectedness of various clinical factors. There is a strong negative association between APACHE II and discharge-BMRC (r=−0.41, p=0.0004), implying that higher APACHE II scores are associated with the decline in muscle strength. This is further corroborated by negative correlations of other treatment interventions like steroids

(r=−0.27, p=0.02), sedation (r=−0.73, p<0.05), NMB (r=−0.62, p<0.05), and vasopressors (r=−0.69, p=1.76×10−11) with discharge-BMRC. These correlations propose that the administration of these treatments might lead to a decline in muscle strength by the time of discharge. Additionally, the time duration of these interventions, depicted by the correlations between sedation days (r=−0.57, p<0.05), NMB days (r=−0.64, p<0.05), and vasopressor days (r=−0.56, p<0.05) with discharge-BMRC, further emphasizes the negative ramifications of prolonged durations of such interventions on muscle strength.

Discharge BMRC and muscle strength: Strong positive correlations with SBT-BMRC (r=0.86, p<0.05), SBT-handgrip (r=0.72, p<0.05), and SBT-quadriceps strength (r=0.67, p<0.05) indicate that enhancements in these parameters can lead to better discharge-BMRC scores. However, a multivariate regression analysis by Eddy Fan et al. found that neither the cumulative dose of corticosteroids nor the use of neuromuscular blockers in the ICU significantly influenced peripheral muscle weakness either at discharge or within the first year post-ALI. (81) Contrastingly, a prospective observational study by De Jonghe et al. identified exposure to corticosteroids as a primary risk factor for ICUAW after 7 days of mechanical ventilation. Notably, this study did not find any significant association between ICUAW and either the cumulative dose or the duration of corticosteroid treatment. (82)

4. Factors influencing discharge Hand Grip:

Moving on to discharge-hand grip, the inverse relationship between APACHE II and discharge-hand grip (r=−0.27, p=0.02) shows the deleterious impact of a heightened severity of the disease, represented by APACHE II scores, on muscle strength. The use

of sedation (r=−0.47, p=0.00003), NMB (r=−0.40, p=0.0005), and vasopressors (r=−0.51, p<0.05) exhibits significant negative associations, while the number of days of these interventions also portrays strong inverse links with discharge-handgrip.

5. Factors influencing discharge quadriceps Strength:

There is a significant moderate negative correlation with APACHE II (r=−0.32, p=0.006), suggesting that higher APACHE II scores are associated with decline in quadriceps muscle strength. Notably, significant negative correlations have been found with the administration of sedation (r=−0.40, p=0.0005), NMB (r=−0.34, p=0.004), and vasopressors (r=−0.555, p<0.05). Moreover, the longer duration of these treatments, as indicated by the number of sedation days (r=−0.388, p=0.0008), NMB days (r=−0.408, p=0.0004), and vasopressor days (r=−0.396, p=0.0006), further reinforces these negative associations. There is a positive correlation observed with parameters like SBT-BMRC (r=0.513, p<0.05), SBT-handgrip (r=0.616, p<0.05), and SBT-quadriceps strength (r=0.617, p<0.05) which imply that improvements in these variables with interventions like early exercise training in ICU are associated with enhanced clinical parameters, stressing the importance of maintaining and improving muscular functions for better clinical outcomes.

6. Factors influencing 6MWD:

In our research, we examined the correlation between 6MWD and APACHE II. The data demonstrated a significant negative correlation (r=-0.3075, p<0.05), suggesting that patients with higher APACHE II scores, reflecting greater illness severity, tend to have reduced 6MWD values. Additionally, we assessed the influence of sedation, steroids, neuromuscular blockers, and vasopressors on 6MWD. Both the use and

duration of these drugs negatively correlated with 6MWD. These observations are consistent with a study by Parry S et al., where higher APACHE II scores and the use of neuromuscular blockers and steroids were negatively associated with 6MWD at three-month intervals post ICU discharge. (83)

In our study cohort, positive correlations were found between 6MWD and muscle strength indicators during SBT: BMRC (r=0.46), hand grip (r=0.58), and quadriceps strength (r=0.48). These results emphasize the essential role of muscular functionality. and the benefit of early exercise interventions in influencing patient mobility. Similarly, Dourado et al. identified a positive relationship between 6MWD and handgrip strength. Given that handgrip strength directly measures the skeletal muscle strength in the hand and distal upper limbs, our findings corroborate the idea that upper-limb muscular strength significantly impacts walking distance. (84)

7. Factors influencing ISWD:

Age showed a negative correlation with ISWD ($r=-0.3227$, $p<0.05$), suggesting that older individuals typically achieve shorter distances in the ISWD. In line with this, a study by Victor et al. identified age as an independent predictor, further emphasizing its negative relationship with ISWD. This observation is likely due to natural decline in muscle mass, muscle strength, and maximal oxygen uptake associated with aging. (85)

The APACHE II score and ISWD had a negative correlation ($r=-0.3540$, $p<0.05$), suggesting that patients with more severe illnesses have reduced shuttle walking distances.

Among the study subjects, significant negative correlations were observed with receipt of steroids ($r=-0.46$), sedation ($r=-0.48$), and vasopressors ($r=-0.48$) signifying the

potential impacts of these drugs on ISWD. These findings underline the judicious use of these treatments, considering their potential to hinder patient mobility.

In our study, we found a significant positive correlation between ISWD and muscle strength measures like BMRC (r=0.46), hand grip (r=0.48), and quadriceps strength (r=0.47) taken during SBT. This implies how muscle strength affects physical performance. Similarly, Michael Steiner et al. studied the link between muscle strength and ISWD in COPD patients. They found that muscle strength, especially in the quadriceps and handgrip, along with age, significantly influenced ISWT. These relationships suggest that improvements in these muscle strength parameters can enhance ISWD performance. (86)

8. Factors influencing SF-36 health survey:

In our study Subjects had an average score of approximately 72.67 on the SF-36 Health Survey, with a standard deviation of 14.07.

The APACHE II score showed a significant negative correlation with the SF 36 ($r=-0.33$, $p<0.05$), suggesting that a higher APACHE II score corresponds to a decline in patient-reported health status. However, in contrast, Denehy L et al. investigated the influence on the Short Form (SF) 36's domain of physical function after 3 months of ICU discharge. Utilizing the SF-36 Physical Component Summary score as the dependent variable, their study found no significant association with APACHE II. (87)

Significant negative correlations with receipt of sedation ($r=-0.4112$, $p<0.05$), NMB ($r=-0.4006$, $p<0.05$), and vasopressors ($r=-0.4294$, $p<0.05$) reflect the potential influence of these interventions on patient-reported health status. This underlines the importance of judicious administration to ensure the best possible quality of life.

Significant negative correlations were observed between the length of sedation and NMB use and the SF 36 scores, having coefficients r=−0.3074 and r=−0.3295, respectively. This indicates that extended periods of sedation and NMB could be associated with diminished SF 36 scores. This accentuates the importance of monitoring and optimizing the duration of these interventions for improved patient outcomes.

Significant negative correlation with the duration of steroids use was seen in our study (r=−0.2668, p<0.05). This is in contrast to the study done by Eddy fan et al. where the cumulative steroid dose had no significant statistical association with the quality of life as assessed by SF 36. (81)

The significant positive correlations observed with SBT-BMRC (r=0.40), SBT-hand grip (r=0.55), and SBT-quadriceps strength (r=0.49) suggest that enhancements in these parameters are associated with higher SF 36 scores. This emphasizes the importance of optimizing early exercise training for improved patient outcomes. In patients who survived acute lung injury, Eddy fan et al. followed up patients for their physical function, over a 3, 6 and 12 monthly period post discharge and at each point SF 36, 6MWD, muscle strength was assessed. About one third had muscle weakness at the time of hospital discharge but most of the patients had a gradual improvement of muscle strength over a 1 year period. (81)

9. Factors associated with Berg Balance Scale:

A noticeable negative correlation exists between the APACHE II and the Berg Balance Score (r=−0.3224, p<0.05), suggesting that patients with more severe illness tend to have diminished Berg balance scores. Furthermore, the positive association between

admission-diaphragm thickness and Berg Balance ($r=0.3452$, $p<0.05$) implies the association between the admission respiratory muscle strength and berg balance scores at the time of discharge. The mode of respiratory support, as represented by IMV/NIV, also displays a positive correlation with Berg Balance ($r=0.315$, $p<0.05$).

However, the treatment interventions like use of steroids ($r=-0.2644$, $p<0.05$), sedation ($r=-0.358$, $p<0.05$), and vasopressors ($r=-0.3592$, $p<0.05$), demonstrate a significant negative association with Berg Balance. Likewise, extended durations and higher doses of these treatments, NMB ($r=-0.2855$, $p<0.05$), vasopressors ($r=-0.2571$, $p<0.05$), and the sedation ($r=-0.2793$, $p<0.05$), further support this negative relationship.

On the other hand muscle strength parameters assessed at the time of SBT, the BMRC ($r=0.3960$, $p<0.05$), hand grip ($r=0.5206$, $p<0.05$), and quadriceps strength ($r=0.4966$, $p<0.05$) positively correlated with Berg Balance. In conclusion, our findings indicate the prominent role of muscle functionality in influencing berg balance as supported by the positive correlations of parameters like SBT-BMRC, SBT-hand grip, and SBT-quadriceps strength

The analysis reveals that the severity of illness, as indicated by APACHE II, correlates negatively with the Berg Balance Score, implying that sicker patients may have reduced Berg balance scores. Conversely, parameters like admission-diaphragm thickness and IMV/NIV correlate positively with Berg Balance, suggesting potential factors that might improve balance. However, clinical interventions such as receipt of steroids, sedation, and vasopressors, along with their durations and doses, correlate negatively with Berg Balance. Muscle functionality parameters, including SBT-BMRC, SBT-hand grip, and SBT-quadriceps strength, show positive correlations, highlighting their role

in determining balance scores.

In conclusion these findings suggest that the Berg Balance Score tends to decrease with increasing severity of illness, as represented by the APACHE II leading to decline in berg balance scores. Factors like admission diaphragm thickness and the mode of respiratory supports how a positive association with Berg Balance. In contrast, the administration of steroids, sedation, and vasopressors, especially considering their duration and dosages, are linked to a decline in Berg Balance. Furthermore, muscle strength parameters assessed at the time of BMRC, hand grip, and quadriceps strength, correlate positively with Berg Balance, emphasizing that intervention which improve muscle strength have a better patient outcome.

SUMMARY

The primary focus of our study, which encompassed 82 patients admitted to intensive care, was to investigate the epidemiology, clinical characteristics, and to identify factors predicting outcomes for critically ill respiratory patients in an ICU in Central India.

1. ***Demographics***- Majority of the study's participants were male (68%) with an average age of 58.54 years. Females were mostly younger, with an average age of 48.35 years. Gender did not significantly impact mortality or ICU outcomes. The age significantly affected ICU outcomes. Body Mass Index (BMI)- Average BMI was 25.1 kg/m^2. No evident relationship was noted between obesity and ICU outcomes.

2. ***Comorbidities***: Among the metabolic conditions, there was a high prevalence of diabetes mellitus (DM) was observed. However, DM itself did not significantly influence ICU outcomes. Regarding respiratory comorbidities, there was a notable incidence of COPD overlapping with TB at 8% and pulmonary hypertension (PHTN) at 29%. Notably, PHTN showed a significant association with poorer ICU outcomes.

3. ***Diagnosis at Admission***- The majority 40% of the patients presented with acute exacerbation of COPD (AECOPD).

4. ***Severity Scoring System***- Mean APACHE II score was 18.47, with most patients having a score between 16-25, suggesting moderate to high severity upon admission.

5. ***Treatment Interventions***: Steroids were used in over half of the patients for 3-6 days. A significant relationship was found between steroid usage and ICU outcomes. Neuromuscular Blockers (NMBs) were used in 58.63% of patients with varied durations. Neither showed a statistically significant relationship with ICU outcomes. About 34.15% required vasopressors. Their usage didn't significantly correlate with

ICU outcomes.

Outcome parameters:

70 out of 82 patients admitted to ICU were discharged

1. ICU Duration and Associated Factors:

Sedation and ICU Stay: Strong positive correlations exist between sedation days, NMB days, and length of ICU stays. Specifically, sedation days (r=0.699) and NMB days (r=0.569) both exhibit a linear relationship with extended ICU durations. Neuromuscular Blockers (NMB) and ICU Stay- Positive correlations are observed between sedation days, NMB days, and ICU durations, reinforcing the potential consequences of extended use of sedation and neuromuscular blockers on ICU stay duration.

2. Invasive Mechanical Ventilation Days (IMV Days) and Associated Factors

A positive correlation is present between higher APACHE II scores and prolonged IMV days (r=0.33). The duration of steroid administration relates positively to prolonged mechanical ventilation (r=0.22). There are strong positive correlations between sedation days and IMV days (r=0.901), NMB days (r=0.790), and vasopressor days (r=0.563). Improvements in parameters like SBT-Diaphragm thickness, SBT-BMRC, SBT-hand grip, and SBT-quadriceps strength are negatively correlated with IMV days.

3. Physical Limitations Post ICU Discharge

5.71% of ICU survivors have BMRC scores below 48, 1.43% possess handgrip strength below 11, and 2.86% have quadriceps strength below 3, indicating ICU-acquired weakness (ICUAW). Factors Influencing Discharge parameters APACHE II scores show a negative correlation with metrics like discharge BMRC, hand grip, and

quadriceps strength. The administration and duration of treatments, particularly sedatives, NMB, and vasopressors, relate negatively to discharge BMRC. Interventions like early exercise training in the ICU are associated with enhanced metrics, including SBT-BMRC, SBT-hand grip, and SBT-quadriceps strength.

4. 6MWD and ISWD: Higher APACHE II scores and drug interventions (sedation, NMB, and steroids) negatively impact 6MWD and ISWD. Muscle strength indicators like BMRC, hand grip, and quadriceps strength positively correlate with both 6MWD and ISWD.

5. SF-36 Health Survey: The average score observed was approximately 72.67, with a deviation of 14.07. APACHE II scores, sedation, NMB, and vasopressor usage show significant negative correlations with the SF-36 Health Survey. Muscle functionality parameters, including SBT-BMRC, SBT-hand grip, and SBT-quadriceps strength, correlate positively with SF-36.

6. Berg Balance Scale

APACHE II scores are negatively correlated with the Berg Balance Score. However, parameters like admission-diaphragm thickness display positive correlations. Clinical interventions such as steroids, sedation, and vasopressors, particularly their prolonged usage, negatively impact Berg Balance. Muscle strength parameters, including SBT-BMRC, SBT-hand grip, and SBT-quadriceps strength, show strong positive correlations with Berg Balance.

In conclusion, this study provided insights into the demographic and clinical profile of critically ill respiratory patients in an ICU in Central India. Several factors such as age, PHTN, and steroids demonstrated a significant impact on ICU outcomes. The findings might aid in forming a comprehensive patient management strategy in ICU settings.

Summary

The factors such as illness severity, treatment type and duration, and muscle strength significantly influence outcomes related to ICU stay, mechanical ventilation, physical limitations, and patient-reported health status. Adjustments to treatment strategies and interventions aimed at preserving and enhancing muscle function can optimize patient outcomes post-ICU discharge.

STRENGTHS AND LIMITATIONS

STRENGTHS

1. Well-defined Focus: The study clearly states the primary objectives, which include understanding the epidemiology, clinical characteristics, and identification of factors predicting outcomes for critically ill respiratory patients in a specific geographical setting.
2. Diverse Parameters: The study provides a comprehensive analysis that includes demographic details, comorbidities, severity scoring, treatment interventions, and various outcomes post-ICU.
3. Strong Statistical Analysis: The study identified significant and non-significant associations between various factors and outcomes, suggesting rigorous statistical testing.
4. Correlation Analysis: The use of correlation coefficients (r values) provides a clear quantification of the relationship strength between different variables.
5. Clinical Implications: By analyzing various treatments and their associations with outcomes, this study offers practical insights in treatment.
6. Patient-Reported Health Status: The inclusion of metrics like the SF-36 Health Survey provides insight into the patients' perspective on their health, adding a qualitative dimension to the findings.
7. Relevance: By focusing on a specific population (Central India), the findings can be particularly useful for healthcare providers in that region.

LIMITATIONS

1. Sample Size: The study size is relatively small with 82 patients, which may not be fully representative of the broader population. Larger studies could provide more robust and generalizable findings.
2. Potential Confounders: While the study provides correlations, it does not seem to control for potential confounders which could impact the results.
3. Limited Gender Diversity: The majority of the participants were male (68%), which might limit the understanding of female ICU patients in this context.
4. Single site study: The results are based on an ICU in Central India, which may not be generalizable to other regions or settings.
5. Lack of Comparative Group: There's no comparative group, which can help in contrasting the outcomes more definitively.
6. Lack of Long-Term Outcomes: The study mainly focuses on outcomes related to ICU stay and shortly after. The long-term outcomes and quality of life post-ICU are not studied.

In conclusion, while the study offers valuable insights, some limitations might affect the generalizability and completeness of the findings. It would be beneficial for future studies to consider a larger sample size, include more diverse settings, and control for potential confounders to further validate and expand upon these findings.

CONCLUSION

Our study on critically ill respiratory patients in a Central Indian ICU has identified key determinants affecting ICU outcomes. Predominantly male, the patients' age, not gender, significantly influenced outcomes. The average BMI didn't exhibit direct links with ICU outcomes, and conditions like diabetes mellitus remained non-influential. However, respiratory comorbidities, especially PHTN, prominently influenced outcomes. Additionally, acute exacerbations of COPD were a primary reason for ICU admissions.

Clinically, the APACHE II score suggested many patients were moderately to severely ill upon admission. Therapeutically, steroid administration was found to be closely related to ICU outcomes. ICU outcome parameters studied showed a direct correlation between extended ICU stays and sedative and neuromuscular blocker use. APACHE II scores, correlated with invasive mechanical ventilation durations. Although patients were given early exercise training, still a concern arose with the high incidence of ICU-acquired weakness among patients emphasizing early exercise training, and judicious therapeutic interventions

Two significant evaluation tools, the SF-36 Health Survey and Berg Balance Scale, indicated profound long-term effects of prolonged ICU stays. In summary, our study outlines the modifiable factors affecting ICU outcomes. Our findings necessitate an integrated patient management approach in ICUs, especially in Central India, with implications for global practices.

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PATIENT INFORMATION SHEET

1. **Purpose of the study:**

   The study will be assessing the outcomes amongst the patients of respiratory ICU in a tertiary care center.

2. **Procedure of the study:**

   Your patients' participation in the study does not imply that the management of your patient will change. Your patient will be given all the available treatment as per standard protocol. After you give consent for the study, we will keep record of the specific parameters of your patient. In addition, at ICU discharge patients' Berg balance scale, hand grip strength, quadriceps muscle strength will be checked. At hospital discharge SF-36 questionnaire will be filled, 6-minute walk test and incremental walk test will be conducted. Your consent is required for the publication of the data from this study.

3. **Benefits from the study to the participant**

   The study will not carry any direct benefit to your patient. The study does not carry any risk to your patient. It does not deprive your patient of any standard treatment required by him as per his medical condition.

4. **Maintenance of confidentiality of records:**

   The identity of the patient will not be revealed in the study results and publications. Your participation in the study and the study records will be kept confidential. The data generated from the study may be used for scientific publications.

5. **Freedom to withdraw from the study at any time during the study period without the loss of benefits that the participant would otherwise be entitled:**

   Your participation in this study is entirely voluntary. The consent you give would not be under any influence or threat and if at any time you want to withdraw from the study you can do so without giving any reasons. Your withdrawal would in no way result in withholding normal medical care, which your patient is otherwise entitled.

रोगी सूचित सहमति (अनुलग्नक 1)

अध्ययन शीर्षक: तृतीयक देखभाल केंद्र में श्वसन आईसीयू के रोगियों के बीच परिणामों का अध्ययन करने के लिए

डॉक्टर: डॉ आशा उंरराजवरपु
प्रधान अन्वेषक: डॉ अलकेश कुमार खुराना
सीओ-अन्वेषक: डॉ अभिषेक गोयल
संस्थान: एम्स भोपाल।

पर्यवेक्षण करने वाले चिकित्सक/अन्वेषक ने मुझे अध्ययन की प्रकृति, उद्देश्य ,अवधि और मेरे रोगी को क्या करना होगा की पूरी व्याख्या मेरे द्वारा सबसे अच्छी समझी जाने वाली भाषा में दी है । मैंने इस अध्ययन में भाग लेने के जोखिमों/लाभों को पूरी तरह से समझ लिया है। मुझे अध्ययन के सभी पहलुओं पर सवाल उठाने और डॉक्टर के साथ पूरा सहयोग करने के लिए सहमत होने का अवसर दिया गया है। मैं जांचकर्ता/अध्ययन के प्रभारी चिकित्सक को मेरी पहचान को गोपनीय रखते हुए प्रस्तुति/प्रकाशन के रूप में मेरे बारे में डेटा जारी करने की अनुमति देता हूं।

रोगी के हस्ताक्षर अन्वेषक के हस्ताक्षर

रोगी का नाम:

आयु: यूएचआईडी संख्या:

PATIENT CASE SHEET

Name Age Gender Occupation-
Smoker/non-smoker Smoking index-
DOA
Co-morbidities-

- Cardiac, Systemic Hypertension
- Respiratory
- Neurological
- DM / Arthritis
- Psychiatric

Past medication history
Past surgical history/trauma

ON ICU ADMISSION

BASELINE ASSESSMENT (At the time of recruitment):
Vitals: HR RR BP SpO2
Ideal body weight / BMI
RASS
INVESTIGATIONS-
ABG- PH PO2 PCO2 HCO3 SpO2
Respiratory failure-
Hb, WBC count
Creatinine / electrolytes
CXR
CT chest
Primary diagnosis
Covid / Non-covid- Yes/No
APACHE II score
Pi max/ Pe max
USG – Diaphragmatic thickness
Ventilator parameters-

- PEEP
- FiO2
- Mode

AT FIRST SBT

Level of co-operation
APACHE II score
Medication use

- Steroids (Cumulative dose)-
- Days of Sedation / NMBAs (Cumulative dose)-
- Vasopressors (Days and cumulative dose)-
- Other agents affecting muscle power (Like aminoglycosides)

USG – Diaphragmatic thickness
Pi max/ Pe max

Muscle strength

- BMRC scale
- Hand grip
- Quadriceps strength

AT ICU DISCHARGE

Muscle strength

- BMRC scale
- Hand grip
- Quadriceps strength

Pi max/ Pe max
Days of mechanical ventilation
Length of ICU stay

ON HOSPITAL DISCHARGE

FUNCTIONAL LIMITATION (6 MINUTE WALK TEST)

PRE-TEST BLOOD PRESSURE	
PRE-TEST SPO2	
PRE-TEST HEART RATE	
PRE-TEST RESPIRATORY RATE	
6MWD	
POST TEST BLOOD PRESSURE	
POST TEST SPO2	
POST TEST HEART RATE	
POST TEST RESPIRATORY RATE	

ISWT

PRE-TEST BLOOD PRESSURE	
PRE-TEST SPO2	
PRE-TEST HEART RATE	
PRE-TEST RESPIRATORY RATE	
NUMBER OF SHUTTLES	
POST TEST BLOOD PRESSURE	
POST TEST SPO2	
POST TEST HEART RATE	
POST TEST RESPIRATORY RATE	
REASON TO TERMINATE	

SF-36 Score:

Berg-Balance Score:

BERG BALANCE SCALE

Category	Component	Score
Sitting balance	Sitting unsupported	0-4
Standing balance	Standing unsupported	0-4
	Standing with eyes closed	0-4
	Standing with feet together	0-4
	Standing on one foot	0-4
	Turning to look behind	0-4
	Retrieving object from floor	0-4
	Tandem standing	0-4
	Reaching forward with an outstretched arm	0-4
Dynamic balance	Sitting to standing	0-4
	Standing to sitting	0-4
	Transfer	0-4
	Turning 360 degrees	0-4
	Stool stepping	0-4
Total		0-56

SF-36 Survey

Date: / /2014 Patient's Name

Visit: □ Pre-op	☐ 6 week	□ 3 month	□ 6 month	□ 1 year

INSTRUCTIONS: Please answer every question. Some questions may look like others, but each one is different. Please take the time to read and answer each question carefully by circling the number that best represents your response.

1. In general, would you say your health is?

Excellent (1)	Very Good (2)	Good (3)	Fair (4)	Poor (5)

2. Compared to one year ago, how would you rate your health in general now?

Much better now than one year ago (1)	Somewhat better now than one year ago (2)	About the same as one year ago (3)	Somewhat worse now than one year ago (4)	Much worse now than one year ago (5)

3. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much: (circle one number on each line)

	Yes, Limited A Lot	Yes, Limited A Little	No, Not Limited At All
A. Vigorous activities, such as running, lifting heavy objects participating in strenuous sports	1	2	3
B. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
C. Lifting or carrying groceries	1	2	3
D. Climbing several flights of stairs	1	2	3
E. Climbing one flight of stairs	1	2	3
F. Bending, kneeling, or stooping	1	2	3
G. Walking more than a mile	1	2	3
H. Walking several hundred yards	1	2	3
I. Walking one hundred yards	1	2	3
J. Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health? (Circle one number on each line)

	All the time	Most of the time	Some of the time	A little of the time	None of the time
A. Cut down on the amount of time you	1	2	3	4	5

spend on work or other activities					
B. Accomplished less than you would like	1	2	3	4	5
C. Were limited in the kind of work or other activities	1	2	3	4	5
D. Had difficulty performing the work or other activities (for example, it took extra effort)	1	2	3	4	5

5. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? (Circle one number on each line)

	All the time	Most of the time	Some of the time	A little of the time	None of the time
A. Cut down on the amount of time you spend on work or other activities	1	2	3	4	5
B. Accomplished less than you would like	1	2	3	4	5
C. Did work or activities less carefully than usual	1	2	3	4	5

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your social activities with family, friends, neighbours, or groups? (Circle one)

Not at all (1)	Slightly (2)	Moderately (3)	Quite a bit (4)	Extremely (5)

7. How much bodily pain have you had during the past 4 weeks? (Circle one)

None (1)	Very Mild (2)	Mild (3)	Moderate (4)	Severe (5)	Very Severe (6)

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)? (Circle one)

Not at all (1)	Slightly (2)	Moderately (3)	Quite a bit (4)	Extremely (5)

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks… (Circle one number on each line)

	All the time	Most of the time	Some of the time	A little of the time	None of the time
A. did you feel full of life?	1	2	3	4	5
B. have you been very nervous?	1	2	3	4	5
C. have you felt so down in the dumps nothing could cheer you up?	1	2	3	4	5
D. have you felt calm and peaceful?	1	2	3	4	5
E. did you have a lot of energy?	1	2	3	4	5
F. have you felt downhearted and depressed?	1	2	3	4	5
G. did you feel worn out?	1	2	3	4	5
H. have you been happy?	1	2	3	4	5
I. did you feel tired?	1	2	3	4	5

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

All of the Time (1)	Most of the Time (2)	Some of the Time (3)	A Little of the Time (4)	None of the Time (5)

11. How TRUE or FALSE is each of the following statements for you? (Circle one number on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
A. I seem to get sick a little easier than other people	1	2	3	4	5
B. I am as healthy as anybody I know	1	2	3	4	5
C. I expect my health to get worse	1	2	3	4	5
D. My health is excellent	1	2	3	4	5

MASTER TABLE

DEMOGRAPHIC FACTORS							METABOLIC CO-MORBIDITIES						RESPIRATORY CO-MORBIDITIES								DIAGNOSIS								
SL NO	Name	GENDER (1=Male: 0=Female)	AGE	BMI/IBW	SMOKING STATUS	SMOKING INDEX	OBESITY	SHTN	DM	THYROID	CAD	RENaNL FAILURE	TB	COPD	ASTHMA	CA	PHTN	PE	ILD	OSA	cardiogenic shock	septic shock	ARDS	poisoning	AECOPD	asthma	IPA	ABPA	Bronchiectasis
1	ajay hardosh	1	55	28	Current	800	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2	ashok kumar ya	1	61	23.1	Ex-smoker	280	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
3	viram yadav	1	53	25.5	Current	300	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
4	sapNaN	0	30	45	Non-smoker	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0
5	ram kumar	1	43	29.5	Current	400	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
6	gurudutt	1	59	23	Current	200	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
7	gulab singh	1	55	22	Current	550	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
8	bolaram thakur	1	75	20.5	Current	150	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
9	ram swaroop	1	40	28.9	Ex-smoker	400	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
10	nadlu lal	1	58	21	Ex-smoker	150	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
11	laxman makode	1	45	22	Non-smoker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	santhosh kumar	1	75	23	Ex-smoker	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
13	kiran kahar	0	35	31	Non-smoker	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
14	rekha bhasuar	0	55	20.2	Non-smoker	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
15	garesh das	1	55	32	Current	250	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
16	raj kunar	1	64	23	Ex-smoker	400	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
17	ghanshyam	1	59	30	Ex-smoker	200	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
18	sakun bai	0	75	24.6	Non-smoker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
19	afza	0	21	23.5	Non-smoker	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
20	moolchand	1	65	24	Ex-smoker	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
21	shankar	1	60	27	Current	800	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
22	hariram rai	1	70	25.6	Current	600	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
23	roopchand	1	56	27.5	Current	450	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1
24	anita	0	45	30.4	Non-smoker	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0
25	ramkali patel	0	75	21	Non-smoker	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0
26	ayub khan	1	80	25.4	Ex-smoker	200	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
27	jagdish yadav	1	45	17.5	Current	350	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
28	rekha verma	0	32	25.8	Non-smoker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
29	chotelal	1	60	24	Current	600	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
30	hari singh	1	59	18.9	Ex-smoker	450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
31	vinod	1	52	20.9	Ex-smoker	250	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
32	rekha	0	43	27.5	Non-smoker	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1
33	pramila	0	63	29.4	Non-smoker	0	1	0	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0
34	vidya sahu	0	40	34	Non-smoker	0	1	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
35	meena	0	38	21	Non-smoker	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
36	moti ahirwar	1	51	21.8	Current	330	0	0	0	0	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0
37	laxmi prasad	1	60	23	Current	800	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
38	shriram	1	82	20.5	Ex-smoker	100	0	0	0	0	0	1	0	0	0	0	0	tm	0	0	0	0	0	0	1	0	0	0	0
39	raj kishore	1	56	26	Current	90	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
40	sandeep	1	27	23.5	Current	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
41	purushottam	1	60	28	Current	800	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
42	kusum bai	0	45	31.6	Non-smoker	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
43	rachna	0	31	22.4	Non-smoker	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
44	sumitra bai	0	45	25.4	Non-smoker	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
45	damodar	1	65	29	Current	300	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
46	awadh Narayan	1	70	24	Current	460	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
47	gyanendra sing	1	44	28	Ex-smoker	350	1	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0
48	kailash	1	55	30	Ex-smoker	200	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
49	ram Naresh Na	1	63	27	Ex-smoker	150	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
50	mithila bai jain	0	73	36	Non-smoker	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
51	ram bai	0	75	27	Non-smoker	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
52	prakash chandr	1	63	22	Ex-smoker	400	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
53	shankar la	1	70	24	Ex-smoker	100	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
54	ajay hardosh	1	55	29	Current	800	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	rajkumari saini	0	45	20.5	Non-smoker	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
56	suresh mandoli	1	38	24	Ex-smoker	150	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
57	lal chand	1	68	25	Non-smoker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
58	lakhan kuchbar	1	48	22	Non-smoker	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
59	sampati	0	57	26	Non-smoker	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
60	gokul keer	1	56	24.5	Ex-smoker	280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
61	gyanendra sing	1	48	23.5	Ex-smoker	220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	ram nivas singh	1	62	28.9	Non-smoker	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	lalita yadav	0	60	34	Non-smoker	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	tej kiran	1	61	31	Current	400	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	asha awasthi	0	52	31	Non-smoker	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0
66	munna lal	1	69	22.4	Ex-smoker	300	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
67	kallu dhakad	1	58	19.4	Current	500	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
68	alka prajapati	0	26	21	Non-smoker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	balwan singh	1	55	25	Non-smoker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	choti bai khuswa	0	40	16	Non-smoker	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
71	dasaiya deenar	1	72	25.5	Ex-smoker	350	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
72	mayawati suma	0	47	18.5	Non-smoker	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
73	shaligram dube	1	59	27.6	Non-smoker	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
74	dharamdass	1	41	28	Current	400	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
75	jitendra kumar	1	37	23.1	Non-smoker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	mohd rafiq	1	67	24	Non-smoker	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	rajesh nadhiya	1	44	24.5	Non-smoker	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
78	santhosh singh	1	85	21	Non-smoker	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
79	kalawati	0	70	21.9	Non-smoker	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
80	anubha	0	39	20.2	Non-smoker	0	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
81	ashok choudary	1	72	22.4	Non-smoker	0	0	1	1	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
82	ram prasad	1	73	20.2	Current	800	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

MASTER TABLE

									ON ICU ADMISSION							Mode of Ventilation		Ventilator Parameters					Drugs recieved			
TB	PE	pulmoNaNry edema	CTEPH	ILD	ca lung	pneumonia	OSA	PNEUMOTHORAX	APACHE II	ABG TYPE	TLC	HR	RR	SPO2	MAP	ADMISSION-DT	IMV/NIV	MODE	PEEP IMV	FIO2 IMV	IMV Pi	NIV EPAP	NIV FIO2%	NIV IPAP	STEROIDS RECEIVED	SEDATION RECEIVED	NMB RECEIVED	VASOPRESSORS RECEIVED	STEROID DAYS
0	0	0	0	0	1	0	0	0	20	1	31000	100	30	65	69	2.32	IMV	PCV	5	60	22	5	NaN	NaN					
0	0	0	0	0	0	0	0	0	18	2	5900	96	35	68	97	2.34	IMV	PCV	5	35	25	6	35	23	1	1	0	1	5
0	0	0	0	0	0	0	0	0	23	2	19,680	108	15	70	83	2.4	IMV	PCV	5	35	25	NaN	NaN	NaN	1	1	1	1	5
0	0	0	0	0	0	1	1	0	23	2	21000	100	32	70	110	NaN	IMV	PCV	18	85	26	NaN	NaN	NaN	1	1	1	1	1
0	0	0	0	0	1	0	0	0	12	1	1310	124	28	94	116	2.33	IMV	PCV	5	30	26	NaN	NaN	NaN	1	1	0	1	4
0	0	0	0	0	0	1	0	0	20	1	24000	110	21	89	70	2.39	IMV	PCV	5	40	26	NaN	NaN	NaN	1	1	0	1	3
0	0	0	0	0	0	0	0	0	22	2	5800	81	14	54	56	2.35	IMV	PCV	5	40	26	NaN	NaN	NaN	1	1	0	1	5
0	0	0	0	0	0	0	0	0	24	2	8340	158	30	40	45	2.33	IMV	PCV	6	70	24	5	30	18	1	1	1	1	5
0	0	0	0	0	1	0	0	0	24	1	600	135	22	45	40	2.24	IMV	PCV	5	100	26	NaN	NaN	NaN	0	1	0	1	0
0	0	0	0	0	0	0	0	0	23	2	9300	120	28	80	52	2.34	IMV	PCV	5	30	24	6	35	15	1	1	1	1	5
0	0	0	0	0	1	0	0	0	19	2	17520	110	21	58	91	2.42	IMV	PCV	5	50	26	5	40	18	1	1	1	0	5
0	0	0	0	0	0	0	0	0	22	2	8900	112	24	78	92	2.23	IMV	PCV	5	60	26	NaN	NaN	NaN	1	1	1	1	5
0	0	1	0	0	0	0	0	0	11	1	15000	130	38	71	78	2.36	IMV	PCV	6	80	18	6	55	15	0	1	0	1	0
1	0	0	0	0	0	0	0	0	22	1	25100	130	32	55	80	2.32	IMV	PCV	5	70	32	NaN	NaN	NaN	1	1	1	1	2
0	0	0	0	0	0	0	0	0	24	2	28900	136	40	45	56	2.34	IMV	PCV	5	80	26	NaN	NaN	NaN	1	1	1	1	5
0	0	0	0	0	0	0	0	0	23	2	13200	135	38	35	81	2.43	IMV	PCV	5	55	27	5	40	18	1	1	0	1	5
0	0	0	0	1	0	1	0	0	18	1	7750	112	36	74	80	2.48	IMV	PCV	8	60	26	NaN	NaN	NaN	1	1	1	1	5
0	0	0	0	0	0	1	0	0	22	2	19170	115	34	76	55	2.36	IMV	PCV	5	40	25	5	35	20	1	1	0	1	4
0	0	0	0	0	1	0	0	0	25	2	24500	160	35	78	65	2.66	IMV	PCV	5	100	26	NaN	NaN	NaN	1	1	0	1	1
0	0	0	0	0	0	1	0	0	23	1	14580	160	35	35	68	2.38	IMV	PCV	6	75	24	NaN	NaN	NaN	1	1	1	1	7
0	0	0	0	0	0	0	1	0	18	2	7640	85	13	76	85	2.42	IMV	PCV	5	40	25	5	50	26	1	1	0	0	5
0	0	0	0	0	0	0	0	0	25	2	11180	142	22	88	78	2.38	IMV	PCV	5	25	24	5	40	25	1	1	0	0	5
0	0	0	0	0	0	0	0	0	24	2	23600	133	41	56	67	2.46	IMV	PCV	5	60	23	5	35	15	1	1	1	1	5
0	0	0	0	0	0	0	0	0	22	1	18900	136	34	70	56	2.54	IMV	PCV	5	80	24	NaN	NaN	NaN	0	1	0	1	0
0	0	0	0	0	0	0	0	0	19	2	16250	116	15	84	74	2.4	IMV	PCV	6	60	24	5	40	18	1	1	1	1	6
0	0	0	0	0	0	0	0	0	19	2	15400	131	20	70	78	2.38	IMV	PCV	5	40	20	5	30	18	1	1	1	0	3
0	0	0	0	0	0	0	0	0	24	2	10600	99	18	76	65	2.23	IMV	PCV	5	45	26	5	30	15	0	1	1	1	0
0	1	0	0	0	0	1	0	0	24	1	15910	132	55	40	60	2.42	IMV	PCV,ECMO	16	100	26	10	100	15	1	1	1	1	7
0	0	0	0	0	0	0	0	0	21	2	7570	98	20	84	94	2.38	IMV	PCV	6	21	24	5	25	24	1	1	1	1	6
0	0	0	0	0	0	0	0	0	18	2	16000	64	14	58	109	2.33	NIV	ST	NaN	NaN	NaN	6	30	18	1	0	0	0	5
0	0	0	0	0	0	0	0	0	20	2	12500	110	30	81	132	2.4	NIV	ST	NaN	NaN	NaN	3	55	16	0	0	0	0	0
0	0	0	0	0	0	0	0	0	15	1	17,500	119	48	68	108	2.24	NIV	ST	NaN	NaN	NaN	8	60	14	1	0	0	0	3
0	0	0	0	0	0	0	1	0	13	2	7700	100	25	51	99	2.54	NIV	ST	NaN	NaN	NaN	8	40	30	1	0	0	0	5
0	0	0	0	0	0	0	1	0	8	2	4070	113	20	62	93	2.4	NIV	ST	NaN	NaN	NaN	10	45	24	0	0	0	0	0
0	0	0	0	0	1	0	0	0	13	2	5640	117	21	94	111	2.36	NIV	ST	NaN	NaN	NaN	5	25	12	0	0	0	0	0
0	0	0	0	0	0	0	0	0	22	2	8490	93	14	82	56	2.35	NIV	ST	NaN	NaN	NaN	5	30	20	1	0	0	1	9
0	0	0	0	0	0	0	0	0	19	2	16700	135	36	82	90	2.36	NIV	ST	NaN	NaN	NaN	5	30	18	1	0	0	0	5
0	0	0	0	0	0	0	0	0	18	2	13580	130	29	68	110	2.24	NIV	ST	NaN	NaN	NaN	5	35	18	1	0	0	0	5
0	0	0	0	0	0	0	0	0	15	2	10810	126	25	86	114	2.42	NIV	ST	NaN	NaN	NaN	5	30	20	1	0	0	0	5
0	0	0	0	1	0	0	0	0	13	1	19160	128	40	46	85	2.6	NIV	ST	NaN	NaN	NaN	8	80	14	1	0	0	0	3
0	0	0	0	0	0	0	0	0	15	2	10040	93	23	78	109	2.4	NIV	ST	NaN	NaN	NaN	6	40	20	1	0	0	0	5
0	0	0	0	0	0	0	1	0	13	2	11540	121	20	56	80	2.58	NIV	ST	NaN	NaN	NaN	12	25	22	0	0	0	0	0
0	0	0	0	0	0	0	0	0	21	2	8860	126	36	71	89	2.22	NIV	ST	NaN	NaN	NaN	5	45	24	0	0	0	0	0
0	0	0	0	0	0	0	0	0	21	2	15100	123	32	78	86	2.44	NIV	ST	NaN	NaN	NaN	4	50	20	0	0	0	0	0
0	0	0	0	0	0	0	0	0	20	2	9990	89	32	80	82	2.38	NIV	ST	NaN	NaN	NaN	5	35	24	1	0	0	0	5
0	0	0	0	0	0	0	1	0	22	2	10390	121	36	78	89	2.48	NIV	ST	NaN	NaN	NaN	14	35	22	1	0	0	0	5
0	0	0	0	0	0	0	0	0	21	2	7340	90	30	64	84	2.48	NIV	ST	NaN	NaN	NaN	6	35	24	0	0	0	0	0
0	0	0	0	0	0	0	0	0	18	2	13600	105	36	54	120	2.5	NIV	ST	NaN	NaN	NaN	5	50	22	1	0	0	0	8
0	0	0	0	0	0	0	1	0	17	2	13100	68	30	68	68	2.32	NIV	ST	NaN	NaN	NaN	10	35	22	1	0	0	0	5
0	0	0	0	0	0	0	1	0	18	2	12100	90	21	80	76	2.48	NIV	ST	NaN	NaN	NaN	10	25	22	0	0	0	0	0
0	0	0	0	0	0	0	0	0	19	2	10500	98	30	62	75	2.43	NIV	ST	NaN	NaN	NaN	5	40	24	1	0	0	0	5
0	0	0	0	0	0	0	0	0	19	2	11900	124	34	68	81	2.4	NIV	ST	NaN	NaN	NaN	5	45	18	1	0	0	0	5
0	0	0	0	0	0	0	0	0	14	2	11300	112	30	56	80	1.82	NIV	ST	NaN	NaN	NaN	6	25	12	1	0	0	0	5
0	0	0	0	0	1	0	0	0	20	1	31000	122	28	72	69	2.2	NIV	ST	NaN	NaN	NaN	8	25	12	0	0	0	0	0
0	0	0	0	0	0	0	0	0	18	2	8300	124	26	65	80	1.88	NIV	ST	NaN	NaN	NaN	5	60	20	0	0	0	0	0
0	0	0	0	0	0	0	0	0	8	2	12470	112	24	72	75	2.38	NIV	ST	NaN	NaN	NaN	3	45	26	1	0	0	0	6
0	0	0	0	0	0	0	0	0	17	2	4320	119	25	84	72	2.16	NIV	ST	NaN	NaN	NaN	5	55	15	1	0	0	0	3
0	0	0	0	0	0	0	1	0	17	2	8160	109	28	76	104	2.24	NIV	ST	NaN	NaN	NaN	10	30	18	1	0	0	0	5
0	0	0	0	0	0	0	0	0	10	2	20100	102	28	86	70	1.98	NIV	ST	NaN	NaN	NaN	6	30	12	0	0	0	0	0
0	0	0	0	0	0	0	0	0		2	8300	110	33	64	86	2.23	NIV	ST	NaN	NaN	NaN	6	40	18	0	0	0	0	0
0	0	0	0	0	0	0	0	0	12	1	10270	110	27	81	78	2.5	NIV	ST	NaN	NaN	NaN	6	40	14	0	0	0	0	0
0	0	0	0	1	0	0	0	0	15	1	8790	90	32	76	86	2.45	NIV	ST	NaN	NaN	NaN	6	40	10	1	0	0	0	5
0	0	0	0	0	0	0	0	0	20	2	20340	120	38	50	90	2.54	NIV	ST	NaN	NaN	NaN	8	45	15	0	0	0	0	0
0	0	0	0	0	1	0	0	0	26	2	20900	110	35	85	50	2.28	NIV	ST	NaN	NaN	NaN	6	60	16	1	0	0	0	4
0	0	0	0	0	0	1	0	0	13	2	12500	93	23	93	78	2.43	NIV	ST	NaN	NaN	NaN	6	21	18	1	0	0	0	5
0	0	0	0	0	0	0	1	0	16	2	4500	106	28	84	72	2.14	NIV	ST	NaN	NaN	NaN	8	30	14	0	0	0	0	0
0	0	0	0	0	1	0	0	0	3	1	8200	83	22	92	99	2.56	Nasal prongs	NaN	NaN	NaN	30	NaN	NaN	NaN	1	0	0	0	2
0	0	0	0	0	0	0	0	0	5	normal	10500	105	23	95	75	2.58	Nasal prongs	NaN	NaN	NaN	35	NaN	NaN	NaN	0	0	0	0	0
0	0	0	0	0	0	0	0	1	25	1	15600	89	36	90	55	2.44	face mask	NaN	NaN	NaN	40	NaN	NaN	NaN	0	0	0	0	0
0	0	0	0	1	1	0	0	0	21	1	46500	145	36	86	75	2.18	Nasal prongs	NaN	NaN	NaN	30	NaN	NaN	NaN	1	0	0	0	4
0	0	0	0	0	0	1	0	0	22	1	15845	126	34	81	55	2.4	face mask	NaN	NaN	NaN	45	NaN	NaN	NaN	0	0	0	1	0
0	0	0	0	0	0	0	0	0	15	1	16500	92	32	90	70	2.4	room air	NaN	NaN	NaN	21	NaN	NaN	NaN	0	0	0	0	0
0	0	0	0	0	0	1	0	0	21	1	14480	125	38	74	73	2.5	NRBM	NaN	NaN	NaN	50	NaN	NaN	NaN	0	0	0	0	0
0	0	0	0	0	1	0	0	0	21	1	15550	120	34	92	78	2.6	room air	NaN	NaN	NaN	21	NaN	NaN	NaN	1	0	0	0	4
0	0	0	0	0	0	0	0	1	18	1	3650	124	38	60	77	2.44	NRBM	NaN	NaN	NaN	60	NaN	NaN	NaN	0	0	0	0	0
0	0	0	0	0	0	1	0	0	18	1	12080	120	34	81	100	3.2	face mask	NaN	NaN	NaN	50	NaN	NaN	NaN	0	0	0	0	0
0	0	0	0	1	0	0	0	0	11	1	8280	98	21	43	115	2.4	Nasal prongs	NaN	NaN	NaN	30	NaN	NaN	NaN	1	0	0	0	6
0	0	0	0	0	0	1	0	0	16	1	24320	107	30	86	95	2.32	HFNC	NaN	NaN	NaN	50	NaN	NaN	NaN	1	0	0	1	5
0	0	0	0	1	0	0	0	0	25	1	9700	130	35	78	120	2.23	face mask	NaN	NaN	NaN	50	NaN	NaN	NaN	1	0	0	0	5
0	0	0	0	1	0	0	0	0	17	1	12240	120	45	49	118	2.2	face mask	NaN	NaN	NaN	40	NaN	NaN	NaN	1	0	0	0	15
1	0	0	0	1	0	0	0	0	19	1	8400	105	40	89	127	2.21	Nasal prongs	NaN	NaN	NaN	30	NaN	NaN	NaN	0	0	0	0	0
0	0	0	0	0	0	0	1	0	21	1	35120	118	26	76	111	2.33	face mask	NaN	NaN	40	NaN	NaN	NaN	NaN	1	0	0	0	4

MASTER TABLE

No of Drug Days			MEAN DOSAGES OF DRUGS									AT SBT			AT ICU DISCHARGE					AT HOSPITAL DISCHARGE				ICU OUTCOME	RASS
SEDATION DAYS	NMB DAYS	VASOPRESSOR days	MEAN STEROID DOSE MG/IMV DAYS	MEAN STEROID DOSE MG/ICU DAYS	MEAN FENTANYL DOSE MCG/IMV DAYS	MEAN MIDAZ DOSE MG/IMV DAYS	MEAN NMB DOSE MG/IMV DAY	MEAN NORAD MCG/IMV DAYS	MEAN NORAD MCG/ICU DAYS	SBT APACHE II	SBT-DT	SBT-BMRC	SBT-HAND GRP	SBT-QUADRICEPS STRENGTH	ICU DAYS	IMV DAYS	D-BMRC	D-HAND GRIP	D-QUADRICEPS STRENGTH	6MWD-METERS	ISWD	SF 36	BERG BALANCE	ICU OUTCOME	RASS
6	5	3	4.2	4.2	274.2	27.4	54.8	786.28	786.28	22	1.96	35	8	3	7	7	35	8.5	3	NaNN	NaN	NaN	NaN	death	-2
3	0	2	81.2	46.4	915	91.5	0	569.75	325.57	13	2.02	46	19.8	3	7	4	50	21.4	4	180	150	65	42	discharge	-2
4	2	4	40	20	716	71.6	3.6	18180	9090.2	17	1.82	44	11.2	3	10	5	NaN	NaN	3	0	0	0	0	death	-2
6	3	2	6.6	6.6	853.3	85.3	17	1189.66	1189.66	23	NaN	20	7.5	2	6	6	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-2
4	0	4	18.6	18.6	1050	105	0	3300	3300.25	21	2.15	0	0	0	4	4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-2
3	0	3	10	10	1066	106.6	0	6020	6020	21	2.32	44	19	4	3	3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	discharge	-2
2	0	2	66.6	28.6	973.3	97.3	0	3440	1474.28	13	2.21	45	14.5	4	7	3	50	22	4	180	140	64	40	discharge	-2
3	2	5	28.5	20	508.5	50.8	3.14	9828.57	6880	19	1.98	35	11	3	10	7	46	13	4	120	0	58	38	discharge	-2
3	0	3	0	0	1066.6	106.6	0	12040	12040	NaN	NaN	0	0	0	3	3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-2
2	1	1	34.3	24	68.5	5.7	9.14	221.14	154.8	17	1.88	46	18	4	10	7	52	24	5	200	180	74	32	discharge	-2
0	1	0	12.5	11.1	150	15	2.12	0	0	13	1.96	50	14.9	4	18	16	56	24.5	5	150	140	69	35	discharge	-2
11	4	1	18.2	18.2	443.6	4.3	5.8	125.09	125.09	21	1.76	14	0	0	11	11	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-2
2	0	1	0	0	350	36	0	559	248.4	9	2.3	35	8	3	9	4	48	17	4	150	100	58	24	discharge	-2
4	4	2	20	20	360	36	72	8900	8900	21	1.9	0	0	0	4	4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-2
5	2	5	46	46	1440	144	9.6	3612	3612	23	1.88	0	0	0	5	5	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-2
2	0	3	40	16	286.6	28.6	0	4730	1892	17	1.97	36	14	4	15	6	48	17	4	150	0	64	38	discharge	-2
8	5	4	16.9	8.8	664.6	66.4	51.69	2381.5	1238.4	13	2.01	16	8	2	25	13	44	13	4	100	0	56	32	discharge	-2
1	0	1	40	16	240	24	0	4730	1892	16	2.13	48	15	4	10	4	52	17	4	200	10	85	45	discharge	-2
1	0	1	500	500	360	36	0	22360	22360	NaN	NaN	NaN	NaN	NaN	1	1	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-3
5	4	3	96	60	1408	140.8	31.4	7052	4407.5	21	1.96	34	11	3	8	5	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-2
1	0	0	100	33.3	640	64	0	0	0	15	2.36	52	19	4	6	2	54	21	5	180	150	78	44	discharge	-2
1	0	0	100	33.3	600	60	0	0	0	21	2.02	45	22	4	6	2	54	23.5	5	150	70	62	36	discharge	-2
13	7	10	16	10	320	36	12.8	24.33	15.2	17	1.88	18	8	3	24	15	42	13	4	100	70	76	38	discharge	-2
1	0	2	0	0	480	48	0	27520	2752	NaN	NaN	NaN	NaN	NaN	10	1	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	-2
7	6	3	23.3	17.5	566.6	56.6	14.83	1121.66	860	16	1.96	42	9	3	16	12	50	17	4	50	0	52	28	discharge	-2
2	1	0	120	30	1200	120	12	0	0	15	2.26	50	20.5	4	8	2	56	24	5	150	90	80	46	discharge	-2
16	1	6	0	0	573.75	57.3	1.31	919.12	612.75	16	1.74	34	8.6	3	24	16	48	17.6	4	220	160	65	38	discharge	-2
24	7	4	10.6	10.6	531.25	53.1	10	430	430	22	2	45	16	3	32	32	50	21	4	180	0	56	35	discharge	-2
3	2	5	56	40	420	42	13	2172.2	1551.57	13	2.15	42	15.8	4	7	5	52	21	5	180	130	72	40	discharge	-2
0	0	0	0	40	0	0	0	0	0	NaN	NaN	52	24.8	4	5	0	60	25.4	4	280	200	88	34	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	56	29.3	4	6	0	56	29.9	4	330	300	84	44	discharge	NaN
0	0	0	0	20	0	0	0	0	0	NaN	NaN	60	23.2	5	6	0	60	24.1	4	130	100	68	40	discharge	NaN
0	0	0	0	50	0	0	0	0	0	NaN	NaN	52	25.2	5	4	0	60	26.5	5	400	380	88	51	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	55	26	5	8	0	60	26.4	5	360	350	86	50	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	60	23.6	5	4	0	60	24	5	150	0	78	44	discharge	NaN
0	0	9	0	23.1	0	0	0	0	8728.88	NaN	NaN	60	26	5	9	0	60	26	5	210	120	79	41	discharge	NaN
0	0	0	0	40	0	0	0	0	0	NaN	NaN	56	28	5	6	0	60	28	5	320	150	81	48	discharge	NaN
0	0	0	0	28.6	0	0	0	0	0	NaN	NaN	56	16	4	7	0	56	18	5	50	20	61	38	discharge	NaN
0	0	0	0	40	0	0	0	0	0	NaN	NaN	56	24	5	6	0	60	27	5	260	160	78	48	discharge	NaN
5	0	0	0	93.75	0	0	0	0	0	NaN	NaN	52	16	4	16	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	death	NaN
0	0	0	0	48	0	0	0	0	0	NaN	NaN	56	27.5	4	5	0	60	27	5	340	150	84	48	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	60	21	4	5	0	60	23	5	380	240	83	50	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	56	26	5	8	0	60	26	5	420	350	79	51	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	56	21	4	8	0	60	24	5	250	240	80	46	discharge	NaN
0	0	0	0	28.57	0	0	0	0	0	NaN	NaN	56	27	4	7	0	60	29	5	350	270	82	47	discharge	NaN
0	0	0	0	25	0	0	0	0	0	NaN	NaN	56	32	5	8	0	60	32	5	320	240	78	40	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	56	21	5	9	0	60	24	5	420	600	88	50	discharge	NaN
0	0	0	0	40	0	0	0	0	0	NaN	NaN	52	28	4	8	0	60	31	5	420	330	85	49	discharge	NaN
0	0	0	0	28.57	0	0	0	0	0	NaN	NaN	54	23	4	7	0	56	24	5	150	130	68	39	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	50	23	5	10	0	56	25.5	5	350	160	79	40	discharge	NaN
0	0	0	0	18.18	0	0	0	0	0	NaN	NaN	50	17	4	11	0	56	18	4	230	150	72	40	discharge	NaN
0	0	0	0	20	0	0	0	0	0	NaN	NaN	52	18	4	10	0	56	18	4	150	130	68	38	discharge	NaN
0	0	0	0	40	0	0	0	0	0	NaN	NaN	60	28	5	5	0	60	23	5	330	200	83	45	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	54	28	5	4	0	56	28	5	380	360	80	44	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	40	11	4	8	0	55	12	5	380	260	75	40	discharge	NaN
0	0	0	0	25.45	0	0	0	0	0	NaN	NaN	60	26	4	11	0	60	26	5	250	220	65	37	discharge	NaN
0	0	0	0	13.63	0	0	0	0	0	NaN	NaN	56	21	4	11	0	60	20.92	5	190	120	72	29	discharge	NaN
0	0	0	0	33.3	0	0	0	0	0	NaN	NaN	56	24.6	4	6	0	60	25.6	5	220	180	69	28	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	52	18.6	4	10	0	56	19	4	210	190	64	28	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	56	18	4	9	0	60	19.82	4	180	150	68	22	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	60	25	4	6	0	60	27	5	390	400	90	56	discharge	NaN
0	0	0	0	40	0	0	0	0	0	NaN	NaN	56	28	4	5	0	60	28	5	280	270	68	38	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	56	27	5	5	0	60	28.2	5	NaN	NaN	NaN	NaN	discharge	NaN
0	0	0	0	16	0	0	0	0	0	NaN	NaN	50	20.2	4	4	0	50	22	4	120	100	38	20	discharge	NaN
0	0	0	0	50	0	0	0	0	0	NaN	NaN	60	25.9	5	4	0	60	28	5	300	290	78	54	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	60	28	5	3	0	60	28	5	210	120	72	40	discharge	NaN
0	0	0	0	26.6	0	0	0	0	0	NaN	NaN	60	29	5	3	0	60	34	5	300	310	82	48	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	60	23	5	4	0	60	29	5	400	590	90	56	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	56	31	4	4	0	60	32	5	380	360	80	49	discharge	NaN
0	0	0	0	13.3	0	0	0	0	0	NaN	NaN	50	9	4	12	0	50	13	4	100	200	48	30	discharge	NaN
0	0	3	0	0	0	0	0	0	2436.66	NaN	NaN	50	11	4	12	0	56	13	4	150	80	65	38	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	52	14	3	8	0	60	17	5	380	300	88	52	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	60	34	5	8	0	60	34	5	400	450	86	50	discharge	NaN
0	0	0	0	40	0	0	0	0	0	NaN	NaN	48	32	5	4	0	50	32	5	100	0	74	46	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	56	24.4	5	12	0	60	23	5	360	210	78	50	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	60	31	5	4	0	60	31	5	400	260	88	54	discharge	NaN
0	0	0	0	21.3	0	0	0	0	0	NaN	NaN	54	30	5	5	0	56	31	5	330	210	82	49	discharge	NaN
0	0	3	0	28.57	0	0	0	0	2530.8	NaN	NaN	56	27	4	4	0	56	26	4	180	130	68	43	discharge	NaN
0	0	0	0	36	0	0	0	0	0	NaN	NaN	52	17.4	4	10	0	54	19	4	220	150	65	36	discharge	NaN
0	0	0	0	30	0	0	0	0	0	NaN	NaN	56	17.4	4	15	0	56	18.5	4	120	80	64	42	discharge	NaN
0	0	0	0	0	0	0	0	0	0	NaN	NaN	50	19.1	4	4	0	53	20.1	4	190	170	80	43	discharge	NaN
0	0	0	0	40	0	0	0	0	0	NaN	NaN	56	25.5	4	4	0	56	26.4	4	220	180	80	36	discharge	NaN